A DOZEN PAPERS

RELATING TO

DISEASE-PREVENTION

ILLUSTRATED

BY

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PREFACE.

THE frequent receipt of requests for copies of tracts on sanitary subjects that I have written during recent years, and an inability to comply with the same, have induced me to reproduce them in their original form, more or less amended and revised. The two last of the series have not before been published. With one exception the order in which they have been severally written has been preserved.

C. B. F.

ROSEMOUNT, ILFRACOMBE.
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THE IMPAIRMENT OF THE EFFICIENCY OF THE MEDICAL OFFICER OF HEALTH PRODUCED BY HIS WANT OF INDEPENDENCE AS A PUBLIC OFFICIAL. (1880.)

(*A Paper presented to the State Medicine Section of the British Medical Association at its Meeting held in Cambridge in* 1880.)

It will, I presume, be conceded by all that the work of a Medical Officer of Health, for the performance of which the Public of this Country pays very heavily in a direct and indirect manner, should be efficient and managed with a due regard to economy.

I am prepared to prove that the public health administration of the country, so far as the office of Medical Officer of Health is concerned, is in a thoroughly inefficient state, and is managed on the penny wise and pound foolish system. The enforced brevity of these remarks will prevent me from showing that an enormous waste of public money is involved in the present multiplicity of inadequately paid Medical Officers of Health, and will permit me to refer only to the subject that forms the title of this paper, to which I must strictly confine myself.

Medical Officers of Health may be divided into two classes, those who are in practice and those who are not in practice.*

1. Medical Officers of Health in Practice:—Nearly all Medical Officers of Health belong to this class and are mostly "general practitioners." How is their efficiency impaired as Public officials? Because as men in practice the enforcement of the public interests must necessarily and unavoidably exert an injurious influence on the goodwill of those on whom they are dependent for their livelihood.

Cases in Proof.—Case 1.—A. B. is Medical Officer of Health, with a trivial salary, of a large Town where he practises. His attention was one day directed to a large quantity of pork in the Market of that Town, which he considered to be unfit for the consumption of the public, as it was in a highly decomposed state. He advised that the meat should be confiscated. After the observance of the form which is usual in such cases, the meat was destroyed. On the evening of the same day he received a visit from two very irate butchers whom he recognized as the fathers of families that he usually attended professionally. These men declared that they were the owners of the condemned meat, which they contended was perfectly wholesome, and, after informing the medical man of the loss in money occasioned by his proceedings, assured him that neither they nor their families would ever require his services again in his professional capacity. This medical man, who has a large family and is poor, plainly told several of his medical brethren living in that Town that he could not afford to and would not again act in such a disinterested manner, otherwise he should seriously injure his practice. The result will of course be that the sanitary interests of the public in that Town must suffer.

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* The Medical Officers of Health of the metropolis are excluded from consideration, as they work under an Act of Parliament which gives them a greater security of tenure than that possessed by the Medical Officers of Health of the country generally.

Case 2.—A Medical Officer of Health, with a mere nominal salary, of a country district where he practised asked me, about two years ago, if I, as Medical Officer of Health, ever found it necessary to advise that cottages should be closed, under Clause 97 of the Public Health Act of 1875, on account of their ruinous condition. I replied, that cottages unfit for human habitation had frequently been closed by order of the Magistrates at the instigation of Sanitary Authorities under my advice, and that, at that very time, proceedings were being taken in the case of some cottages in my district, through the roofs of which rain streamed during every shower, and where the owner, a member of one of those Sanitary Authorities, did nothing but advise his tenants to keep their umbrellas up whilst in bed. I asked this Medical Officer of Health whether *he* had had any occasion to advise the closure of cottages unfit for human habitation in his district. His reply was curt but straightforward : "I am not such a fool! Why, every cottage in my district belongs to the Squire, who with his family are my best patients, and whom I could not afford to offend."

Case 3.—"The Public cannot expect," said a medical man once to me, "that I, who receive from them for my public services next to nothing, should do my best to prevent the extension of so remunerative a disease as small-pox, every case of which I consider, taking the average of fees obtained from rich and poor, to be worth to me a £5 note."

Many more instances could be adduced, but surely no more are requisite to prove what must be almost self-evident.

When that mischievous Act of Parliament, the Public Health Act of 1872, which has been the origin of all the evils from which the Public Health Administration of the country has suffered, inasmuch as the basis of it was radically unsound, attaching as it did Public Health to Poor Law work, as if sanitary affairs concerned only Paupers ; when, I say, that Bill was being discussed in Committee I wrote to Drs. Playfair and Brewer, the representatives of the Medical Profession in the House of Commons, pointing out the dangers into which we were drifting. They both replied that they distinctly perceived the dangers, and, notwithstanding their efforts to avert them, found themselves powerless. The large majority of those members of the medical profession who have for so many years worked the existing Poor Law have, so long as I can remember, condemned it. The very fact that Parishes exist in this country in which Pauperism is hereditary in nearly every family shows in itself that the system is unsound. Was it not a vicious policy to graft a young shoot on a stock (with which it has but a partial relationship) that ninety-nine out of every 100 gardeners practically acquainted with it assure us is bad ? Granting, however, for the sake of argument, that the Poor Law worked satisfactorily and was all that could be desired, the framers of the Public Health Act of 1872 should surely have entrusted the Administration of Sanitary affairs to the intelligent and educated, rather than to those who knew nothing about them, did not care to learn, and whose sole concern was as to "how best to keep down the rates." Far better would it have been, notwithstanding the attendant difficulties, to have created a representative body, possessing some knowledge of State Medicine, to deal with Public Health affairs amongst all classes of the people, than to have affixed the stamp of Pauperism on all things sanitary, and conferred the permissive powers of the Act on those who are notoriously ignorant of and indifferent respecting the subject.

I know two or three provincial consulting physicians who, by way of experiment, have acted as Medical Officers of Health, but this trial has, I believe, failed. Such gentlemen, who are for the most part men of age and experience, cannot tolerate the evasions, procrastinations, and equivocations of the average uneducated Poor Law Guardian, on whose shoulders has been placed the responsibility of looking after the health of the community, and whose only wish is to successfully evade the performance of the duties therein involved and to keep down the rates. Moreover, such Physicians have not, in consequence of their age, had special training in Sanitary Work, so as to fit them for carrying on those chemical and meteorological investigations which are so closely associated with studies concerning the preventable diseases.

2. MEDICAL OFFICERS OF HEALTH NOT IN PRACTICE :—When, by the Public Health Act of 1872, the appointment of Medical Officer

of Health was made compulsory throughout the country, it was suggested by the Local Government Board to some Boards of Guardians, that they should unite with neighbouring Boards of Guardians to form Combined Districts, when they would be enabled to offer salaries which would attract able men whom they could then debar from private practice. They thought that by this means some really good men would be secured, who would have no private interests to serve, but who would have every incentive to act with independence and impartiality, treating both rich and poor alike without distinction of persons. They naturally considered that such a union would also be the most economical method that could be devised for the ratepayers. In consequence of the pressure exerted by the Local Government Board, several of these combined appointments were made for terms of three or five years, the candidates being led to believe that, at the expiration of these periods, they would be re-appointed, unless guilty of anything that warranted their dismissal, otherwise the majority of the applicants for these offices who were in practice would not have resigned those practices. They, in fact, had every reason to think that as they were partly paid by, and as they were under the control of, the Local Government Board (which Board controlled the Boards of Guardians) they would be dealt with justly, and not be in *a worse position* than the Union Medical Officer, whose appointment can only be determined by death, by insanity, and proof of crime or scandalous neglect of duty. Although some of these Combinations have recently been broken up in consequence of the weak-kneed condition of the late Government, who feared to displease the agricultural interest by exerting the compulsory powers which they possessed in order to prevent such catastrophes, most of them still survive in a mutilated condition, more or less reduced as to area of district and salary.

The Medical Officer of Health has been wrongly regarded by some as a Public Official, who is to quietly wait until his advice is asked before he gives any, and he is irrelevantly told to remember that the Sanitary Authorities are the representatives of the opinions and wishes of the ratepayers. Every one who attentively studies the "Duties of the Medical Officer of Health" as prescribed by law can very easily see, unless he is disinclined so to do, that the Medical Officer of Health has to frequently take the initiative and to warn against dangers to the Public Health respecting which the members of most Sanitary Authorities know nothing, and care less. Men of the world know too much of the tactics and intrigues pursued at local elections to be enabled to believe in the purity of such contests. My own large experience has taught me that the opinions and wishes of the great body of ratepayers are not *truly* represented by the majority of Sanitary Authorities, which consist mainly of the spokesmen of the noisy, obtrusive, ignorant, and loquacious minority. If they represent (as no doubt in a strictly legal sense they do) the opinions and wishes of the ratepayers, so also they represent the *ears* to which suitable advice should be addressed to guide those opinions and wishes. Unhappily the great body of ratepayers take no interest, or very little, in the quality of their representatives. We see this indifference manifested in the municipal elections throughout the country, the intelligence and independence of the local community, as represented by its gentry, having gradually given place to the half-educated with their fully recognized "wheel within wheel" delinquencies.

Now comes the question, How is the Efficiency of the Medical Officer of Health of a Combined District impaired through his want of Independence as a Public Official? If, in the conscientious performance of his duties to the public—a part of which consists in sending to the Local Government Board a copy of every special report that he writes, which sometimes brings upon his Sanitary Authorities a severe remonstrance as to the neglect of their Districts—he happens to offend the prejudices of his ignorant masters, whose own property is often in a deplorable state, the threat of disruption of his district and reduction of his salary, although not openly expressed, is secretly felt to be the punishment in store for him. The Local Government Board, although possessed of the legal power of preventing such a gross act of injustice when it threatens one of its servants, a half of whose salary it pays, is afraid of acting justly and righteously, and abandons him to their mercy.

Cases in Proof.—Case 1.—The Blackpool, Lytham, and Fylde Combination in Lancashire, where disruption took place on the plea of economy, but really in consequence of the representations of Dr. Hinckes Bird, its Medical Officer of Health, respecting the insanitary state of the Parish of Marton. Vide "Sanitary Record," May 1, 1875, and July 22, 1876.

Case 2.—The Hertfordshire Combination, where the Royston Union dismissed the Medical Officer of Health, Dr. Ogle, on the plea of economy, but, in truth, because he reported on the continued insanitary state of its villages. Vide the "Sanitary Record," May 3, June 14, August 9, August 30, and September 20, 1878.

Case 3.—The Essex Combination of Three Sanitary Authorities, one of which withdrew from the Combination on the plea of economy, but in reality on account of its displeasure at a Report written by myself, as Medical Officer of Health (which Report was afterwards confirmed by Dr. Thorne, one of the Medical Inspectors of the Local Government Board), on the Insanitary State of one of its Villages, which drew from the Local Government Board a very severe letter to the defaulting Authority on its neglect. Vide "Lancet," July 12, 1879, "Sanitary Record," July 15, 1879, and October 20, 1879, "Medical Times and Gazette," August 2, 1879, and "British Medical Journal," September 20, 1879.

How can the Medical Officer of Health of a Combined District be expected to act with independence and impartiality, or with a sole regard to the interests of the Public, with this danger of the disruption of his District always hanging over his head? Why should the tenure of office of a Medical Officer of Health be less secure than that of the Union Medical Officer?

It will be noticed that in both classes of Officials, viz., Medical Officers of Health in Practice, who are dependent on the goodwill of their patients and of the Sanitary Authorities with which they are connected, and Medical Officers of Health of Combined Districts, debarred from Practice, who are dependent on the goodwill of their Sanitary Authorities, the evil impairing their efficiency is the same, acting, however, more disastrously to the Public in the case of the former class than in the case of the latter.

A man should never be placed in such a position that his own private interests must inevitably clash with the public interests. Although this assertion may be almost regarded as a truism, yet, as applied to the office of Medical Officer of Health, it seems to be utterly ignored, such is the inconsistency of our rulers and law-givers, who yet appear to be endowed with sufficient common sense as men of business to avoid such sources of corruption as regards their own dependants.

We cannot shut our eyes to the fact, however much we may try to avoid looking the subject fully in the face, that the evil which I here point out is a source of rottenness to the whole of the sanitary administration of the country.

An apology from me is due for bringing before this Association a matter which has been by discussion rendered almost threadbare. My excuse is, that this evil, notwithstanding all that has been written and said, is still omnipresent, and taints everything relating to Public Health. A constant reiteration of the fact of the continuance of the evil seems needful before the

Public will assimilate the truth. This is the more extraordinary, seeing that the Public always seems to be on the *qui vive* to discover sources of rottenness in public places, be they sinecures, or instances of nepotism, or shams, or lucrative posts characterized by great "activity in doing nothing." The remedy for the prevention of this disease which saps the strength and is undermining the Public Health constitution has been frequently pointed out by the Medical Profession, and notably so by the British Medical Association through its State Medicine Parliamentary Committee.

Postscript.—A Physician in practice, who is regarded by his very numerous friends as one of the best (in every sense) of men, once expressed to me some sympathy for Sanitary Authorities, and showed an evident desire to himself endeavour, by the exercise of tact, conciliation, and perseverance, to win the confidence of such much maligned bodies. I did not attempt to dissuade him from an enterprise on which he was bent, but, having informed him of my experience, said, "Try it." He was subsequently appointed Medical Officer of Health to a large Combined District, and now writes to me in this strain: "You were right enough about health appointments."

As illustrative of the state of chaos into which the Public Health Service has drifted, I append the following memoranda of a visit received by me since the foregoing was written, from an old fellow-student who is now a medical man in practice. He informed me that he had been Medical Officer of Health for some time over a large number of parishes; that he had never seen the Public Health Act, 1875, nor heard of it, for he thought that the old sanitary statutes (which had been for five years repealed by it) were still in force. He had never seen or read over the duties of the Medical Officer of Health, as prescribed by law, and did not know that it was the duty of a Medical Officer of Health to send a copy of any Special Report to the Local Government Board; he had never sent any. He confessed that he would not dare to interfere with the property of any Guardian, in however bad a state it might be, for that would be an act of suicide and he should lose his salary. He said that the Inspector of Nuisances "did just nothing," and was not under his control in the slightest degree; that this official was paid very little, and had lots of other business to attend to.

He expressed his belief that the Administration of the Public Health was a huge sham.

With this opinion I think the majority of those who have emerged from "behind the scenes" will agree.

ON COKE AS A FUEL IN RELATION TO HYGIENE. (1873.)

The majority of those who exert the powers of observation, with which every one is to a greater or less extent endowed, must have remarked that some kinds of fuel furnish heat which is more pleasant than that supplied by other varieties. It is, moreover, a matter of common experience, that the heat radiated by iron stoves in which coke is consumed does not produce such agreeable sensations as that evolved from an open grate in which ordinary coal or wood is burned.

The influence of certain cheering impressions on the nervous system, which the sight of a bright and lively fire (connected as it is with happy associations) generally awakens, cannot be altogether ignored. But many people of nervous and sanguine temperaments, especially the plethoric, most of those indeed who are sensitive to changes in atmospheric states and conditions, are effected injuriously if they remain for some time in a room or office warmed by an iron stove in which coke is consumed. They experience a sense of "malaise," and sometimes a difficulty of breathing, slight dizziness, confusion of ideas, headache accompanied by a feeling as if a tight band encircled the forehead and temples ; in one word, the symptoms of narcotic poisoning, which are speedily dissipated on removal to the fresh air.

There are some persons who are conscious of a feeling of discomfort whenever they remain for a short period in rooms heated by direct radiation from hot-water pipes, or steam pipes, or German stoves. Distinct kinds of heat undoubtedly exist, just as we have distinct shades of each of the several primary colours. The quantity or degree of heat, as indicated by a thermometer, may be the same, yet the quality of the heat may be different.

The sun, burning coal, burning wood, hot-water pipes, and stoves, give forth heating rays which can by some be distinguished by virtue of a difference in the impressions afforded. The intermixture of the heating rays with luminous rays from some sources of heat may possibly be connected with these variations, or they may be caused by differences in the kind of heat rays.

The heating rays of the Solar Spectrum differ from each other in their degree of refrangibility, in the number of undulations of the "ether" by which they are produced, and in their wave-lengths. Those of greatest intensity are quite visible, being situated beyond the red extremity of the Spectrum, where there is no light. The rates of vibration of these non-luminous heat-rays are less than those of the luminous heat-rays.

Some reasons have existed for thinking that there are nerve fibres in the skin which are acted on by heat and cold, but by no other stimuli. Cases of paralysis have been observed, in which sensibility to heat and cold has been destroyed, whilst common sensation and touch have remained. If the skin is supplied with nerves possessed of these special endowments, it would be interesting to ascertain the effects on them of the *several varieties* of the heating rays.

Living as we do in times when coal, which has been considered to be the backbone of the nation's prosperity, is so costly that our poorest neighbours are almost debarred from procuring it, and at a period when the inventive faculties of the community are stimulated in every way to devise arrangements for the economical employment of fuel, it is desirable to state clearly the teachings of sanitary science, as regards the evil effects on the health, of the combustion of coke in iron stoves, especially those formed of cast iron.

Public buildings, churches, colleges, schools, barracks, etc., are very often heated by means of coke-burning iron stoves, some of which are provided with troughs and pans of water to counteract the aridity of the air which they are supposed to induce. During the recent "Coal Famine" the demand for coke for domestic purposes has been perhaps greater than has ever been before known in this country, particularly amongst the labouring classes.

In the United States, anthracite (called in Ireland "Kilkenny coal," and in Scotland "blind coal"), which bears a great resemblance to coke, and is equally objectionable as ordinarily consumed, is most extensively used. Dr. Derby asserts * that "ninety-nine dwelling-houses out of a hundred in Boston are, in whole or in part, warmed by this fuel burned in iron stoves, or in the iron fire-pot of a furnace, which is but a stove in another form."

The following questions now naturally arise in our minds :—

1. What is the cause of the injurious effects with which the consumption of coke and coal in iron stoves is attended? and,

2. Can coke be employed as a fuel, without exercising a deleterious influence on the health?

Query No. 1.—The disagreeable feelings often complained of by those who come occasionally into the vicinity of cast-iron coke-burning stoves, have been attributed by the majority of those who have studied these matters to the removal from the air of its normal amount of humidity. Some, ignorant of chemistry and toxicology, have declared that they are owing to the abstraction of oxygen from the air.

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* "Anthracite and Health."

The experiments of Dr. Derby would appear to show, that the air surrounding iron furnaces raised to a high temperature is not more dry than the air in the immediate neighbourhood of one which is slightly warmed. So long as moisture is obtainable from adjacent objects, the Hygrometer will not, of course, exhibit any difference. Peclet writes, in his, "Traité de la Chaleur," vol. iii., page 100, "The drying of air by metallic stoves is only apparent. The air appears to be more dry because it is hotter, and can therefore dissolve more vapour. The higher the temperature, the farther it is removed from saturation."

The truth is, that heated air possesses a great avidity for moisture, and that the capacity of air to hold water in the form of invisible vapour increases as its temperature rises. To obtain it, a requisition is made on everything near the source of heat, such as clothing, furniture, etc., as nearly all substances contain a certain amount of hygroscopic humidity. The animal body when thus taxed is affected injuriously.

Removal of moisture from the surface of the skin creates in many a feeling of irritability and discomfort; whilst the excessive exhalation from the lungs and mucous membrane of the throat, larynx, and trachea often produces an irritation and cough which may lead to disease.

Here is an example. A schoolmaster applied to me some months ago on account of a feeling of dryness in the throat, accompanied by "a tickling cough." The mucous membrane of the fauces presented, on examination, a congested and granular appearance. In the absence of any pulmonary or other disease, I inquired as to the mode by which his house and schoolroom were heated. He informed me that the latter was warmed by an iron stove. I recommended him to place on the stove a basin, and to always keep it filled with water. He very soon lost his distressing symptoms. Being sceptical as to whether or not the basin of water had been the means of effecting his cure, he removed it from the stove. The same symptoms recurred in a short time, and were again relieved on replacing the basin. The heated air, unless supplied freely and readily with the moisture which it craves, will abstract it from every object in the immediate vicinity.

Languor and oppression are most commonly complained of by those who, unaccustomed to heated cast-iron stoves, remain for a short time near them. Sometimes people are affected with additional symptoms, such as those above enumerated, which are indicative of the action of a narcotic poison. Now, what poisonous gases are generated by the combustion of coke, coal, etc.? Carbonic oxide, carbonic acid, the carburetted hydrogen gases, and sulphurous acid.

The last-named, which is so abundant in the air of coal and gas-burning towns* (where it serves a useful purpose, being a powerful disinfectant), hardly deserves to be placed in juxtaposition with such deadly agents as carbonic oxide and carbonic acid.

The light and heavy carburetted hydrogen gases may be excluded from our consideration, for they are not very poisonous, and are yielded in minimum quantity by coke, the fuel which now especially engages our attention. As the carbonic acid, which is produced by the lower layer of burning matter forming the fire, rises through the heated mass above, it unites with more carbon and becomes changed into carbonic oxide. This latter gas may sometimes be seen burning on the surface, and yielding a pale blue flame. When it burns in contact with air, carbonic acid is reproduced. The presence of carbonic oxide is a sign of imperfect combustion. The loss of heating power when this gas escapes from a stove has been estimated at 67 per cent. Some consider carbonic acid to be a positive poison, whilst others think that it kills by obstructing respiration. Carbonic oxide is believed by all to be a most virulent poison, even *in the smallest quantities.*

As both of these gases are given off in the combustion of coke, anthracite, and charcoal, and as deleterious effects may be occasioned by either, and especially by the carbonic oxide, any escape of them into the air we breathe is to be carefully guarded against. Claude Bernard and M. Guerard both assure us that *a mixture of these gases is more hurtful than either respired alone.*

The reader may imagine that, as stoves are furnished with flues, every provision is made for the removal of all the products of combustion into the outer air. Unfortunately, these poisonous oxides of carbon do not all pass away by this outlet, but enter the rooms which the stove is designed to warm, in three ways: (*a*) through the iron; (*b*) at the junctions of the separate pieces of which a stove is made; and (*c*) in consequence of downward currents of air.

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* One of the causes of the difficulty which is experienced in cultivating trees and shrubs in cities is, in my opinion, to be found in the presence of this acid, which is highly destructive to certain kinds of plants.

(*a*) *Through the iron.*—MM. St. Claire Deville and Troost have discovered that iron and several other metals permit, when heated, the passage through them of the gases of combustion. They write,* "The porosity results from the dilatation induced by heat in the intermolecular spaces." The researches of Tyndall on the penetration of metals by gases, and of Graham on the absorption of carbonic oxide by iron, corroborate these experiments. It is by virtue of the absorptive power possessed by iron that this metal is converted into steel. We learn from Dr. Derby's little work, before alluded to, that so long ago as 1865 Velpeau communicated to the French Academy some observations of Dr. Carret, as to the unhappy influences on the health which attend the use of cast-iron stoves. General Morin interested himself in the matter, and asked MM. St. Claire Deville and Troost to analyse the air encircling a heated stove.

These chemists found: (1) that tubes of cast iron are incapable of maintaining a vacuum; † (2) that carbonic oxide, carbonic acid, and hydrogen gases pass through iron, and to a still greater degree through cast iron; and (3) that carbonic oxide, absorbed in our stoves by the internal surface of the cast iron, diffuses itself from the external surface into the atmosphere, and that this process goes on continuously. They have besides determined the quantity of the oxides of carbon present in the air surrounding heated stoves, and the proportion of carbonic oxide which permeates through a given surface of a cast-iron stove, as well as that which the metal absorbs and retains.‡ The passage of the comparatively harmless sulphurous acid through the crystalline structure of cast-iron stoves is often recognized by its pungent and peculiar smell.

The poisons with which we are now principally concerned are the inodorous carbonic oxide and carbonic acid gases, especially the former, into which a portion of the latter, according to the experiments of M. Dumas,§ is converted by heated iron.

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* "Comptes Rendus," T. 57, p. 965, 1863.

† The soil in which pipes containing illuminating gas are imbedded has often a powerful odour of it, and is frequently much discoloured. This is, without doubt, partly occasioned by loss through the walls of the pipes, to guard against which, so far as is practicable, gas companies test their pipes by submitting them to a powerful pressure, and lay them in a concrete composed of lime, etc., which adhering to them forms a protective coating that lessens the escape.

‡ The important experiments of these chemists are contained in "Comptes Rendus," T. 57, 1863, and T. 59, 1864.

§ "Comptes Rendus," August 26, 1872.

(*b*) *At the junctions of the separate pieces of which a stove is made.*—Stoves become very leaky in time. After being employed for only a few months, they will sometimes be found, if filled with water, to be incapable of retaining it. The frequent expansion and contraction of the metal tends to separate from one another the pieces of which a stove is constructed. To obviate this leakage, which fastenings are utterly powerless to prevent, a wrought-iron stove has been recently introduced, consisting of two pieces of metal. The connection between the two portions is made by allowing the edge of one to rest in a groove of the other, which is filled with sand.

(*c*) *In consequence of downward currents of air.*—In spite of a powerful draught and the most perfect construction of a chimney, currents will occasionally descend, in consequence of sudden gusts of wind, the slamming of doors, the mode in which the fire is built up, etc. All housekeepers have to deplore the necessity for removing particles of soot from the mantel-shelves and sometimes from the furniture.

When coke or anthracite, which do not contain the illuminating gases, and which burn without flame and smoke, are used in our fire-grates, we can generally perceive an odour of sulphurous acid on the addition of fresh fuel, by placing the face close to the mantel-shelf. If this acid, which is detected by its irritating fumes, escapes then into our rooms, it may be fairly presumed that the inodorous gases, carbonic oxide and carbonic acid, which are simultaneously developed, are associated with it.

Some may inquire, "Is it then unadvisable to burn coke in open fire-grates?" I will answer this question by narrating an incident that recently came under my notice. An extremely delicate child, afflicted with a pulmonary affection, was ordered, during the prevalence of the easterly winds, to be confined to a suite of rooms, all maintained at one temperature, during both day and night, by coal fires in open fire-grates. As coals were very expensive, the mother after a time adopted the economical measure of burning coke. On entering the sitting-room, after the introduction of the coke, to visit the little patient, I experienced a sense of general oppression, of weight about the head, and a difficulty in breathing air which seemed to have lost all freshness. The child was suffering from the symptoms of narcotic poisoning. She complained of great lassitude and of "a feeling as if a band was tightly bound around the fore-head." The rooms were not again warmed by this fuel.*

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* Vide case of poisoning by Coke in "British Med. Journal," March 6, 1875.

It is to be observed that those who are unaccustomed to come into the vicinity of iron coke-burning stoves are more liable to be unpleasantly affected than those who are frequently near them. There is a certain tolerance of the poison of carbonic oxide acquired in time by those who habitually breathe it in small amounts, just as we see in the case of arsenic, opium, etc.

The hurtful effects of carbonic acid are transitory, whilst those of carbonic oxide are persistent. Claude Bernard, Thudichum, and others have ascertained that this peculiarity with regard to carbonic oxide is due to the formation in the blood of a fixed compound called carbonic oxide hæmoglobulin—a substance possessing a characteristic spectrum and peculiar chemical properties—and that it could only be removed from the blood by converting it into carbonic acid. The latest investigations throw a doubt on the formation of this compound. Zuntz* finds that carbonic oxide may be extracted from blood by means of the air pump, but that its removal is attended with more difficulty and requires a much longer time than would be necessary for the abstraction of oxygen.

Dr. Gréhant has recently communicated a series of experiments to the Society of Biology of Paris, tending to show that in cases of poisoning by carbonic oxide this gas is not transformed in the organism into carbonic acid, and that the presence in the air of even a thousandth part of this dangerous gas is sufficient to prevent the elimination of the poison.

Query No. 2.—As carbonic oxide and carbonic acid pass through heated cast-iron stoves with facility in consequence of its porosity, it is to be feared that wrought iron, although not so open in its texture as cast iron, may yet permit of the passage of these poisonous products of combustion. If wrought iron is permeable, it is probably only slightly so.

Dr. Derby suggests that stoves aud furnaces should always be made of "wrought-iron plates riveted together as tightly as those of a steam boiler, so that the whole apparatus shall be practically of one piece."

He informs us that stoves enveloped in Russian sheet-iron (rolled iron covered with a silicious glaze) have been found to give a more agreeable heat than cast-iron ones. Coke and anthracite may be burnt in the porcelain stoves so common in Germany, especially the Meissner's stove (the effects of which, when heated, on the air were studied for many years by Haller),†

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* Pflüger's Archiv, v. 584—588.

† "Die Lüftung und Erwärmung der Kinderstube und des Kranken Zimmers."

THE SUPPLY OF RAIN-WATER TO COTTAGES IN RURAL DISTRICTS. (1875.)

One of the greatest desiderata in connection with the administration of the public health service is to be of one mind as to the great question of the supply of the people of this country with a sufficiency of pure water in circumstances where the sinking of wells is quite impracticable. The distress on account of the scarcity of water during periods of drought, such as we have just passed through, and the cost of its conveyance in some districts during every summer, can hardly be understood by those who live in counties abounding in springs and streams. Two or three years ago, public prayers were offered up against the continuance of a heavy rainfall, which it was our obvious duty to have stored. The curious spectacle of people at their wits' end on account of scarcity of water for domestic purposes, begging it by day and stealing it by night, may sometimes be witnessed, whilst thousands of tons are falling around them, destroying their pigs and washing away their cattle,—

> "Water, water everywhere,
> But not a drop to drink."

If we want to make men temperate, we must give them pure water ready at hand, and not allow them an opportunity of saying, as many do now, that they often visit the public-house because they have nothing better than ditch-water to quench their thirst. Hundreds of those who live on certain water-destitute geological formations, such, for example, as the clay, have no other water supply than is to be obtained from ponds and ditches that contain water full of animal and vegetable life, which is sometimes, during the hot days of summer, quite offensive to the smell. This sort of supply, in addition to being highly objectionable in itself, fails in the hottest weather, when water is most wanted, and is always liable to pollution. Many living on this same clay, in certain situations where it is intersected by water-bearing gravelly strata, are possessed of good wells. The question of interest is, however, "How is water to be provided to the cottager living on those portions of this clay not containing any superficial sandy or gravelly strata, and on other water-destitute geological strata where well water or spring water is not obtainable within a reasonable distance?" To sink artesian wells 200 or 300 feet in depth for isolated cottages is, of course, out of the question. The expenditure would often be greater than the value of the property. It would be unfair to compel owners to furnish water at such a price, and a Rural Sanitary Authority would not be justified in taxing a parish in such a manner. The supply of the country districts by the storage of rain-water has been strongly urged of late. There is a feeling prevalent, unfortunately, that rain-water is always dirty, and is consequently unwholesome. This idea is natural, and is mainly to be ascribed to the fact that rain-water, as known to the public, stored in water butts that are rarely cleansed and are open to the entrance of any filth, presents certainly neither a very cleanly nor inviting appearance, being generally of a black colour and full of insect life. Now, the rain-water as used for drinking and cooking purposes in my family is not to be distinguished during spring, autumn, and winter from the purest spring water. In summer it possesses a slightly flat taste, and lacks the coolness of spring water, partly because of its softness, and partly because my tanks are above ground instead of being (as they should be) half under ground. It is very doubtful whether it is wise to supply towns and cities with the rain that falls in them for drinking purposes, even if such a sooty mixture could be rendered potable. Town air is exceedingly impure, and rain is the great air-washer. Rain and dew in descending carry with them the organic and other impurities contained in the air. It has been proposed, indeed, to measure the relative sanitary condition of towns by a chemical analysis of their rain-water. In country districts this objection, of course, does not apply. The only argument possessing any weight against the use of rain-water is that it does not contain lime, which is so useful in strengthening and building up the bones of young animals during their period of growth. Some eminent men consider that young creatures solely derive the lime which they require from their food,* and regard water as simply a diluent or solvent in nutrition, but it is evident that the young animal supplies the wants of its system for lime from every available source. It has been represented by Dr. Letheby that towns supplied with soft waters have a higher death-rate than those furnished with hard waters. The causes that combine to form a high or low death-rate are many and various. Dr. Cameron points out,† in reply to Dr. Letheby's assertions, that the death-rates of Glasgow and Manchester and other towns supplied with soft water were not lower when the water furnished to them was hard, and that the public health of Dublin has improved since the substitution of the soft water from the Vartry for the hard water with which that city was formerly provided. Mr. P. H. Holland very properly writes, with reference to a statement of Mr. T. Spencer in the "Sanitary Record" in support of Dr. Letheby's view, to this effect :—"He appears to attribute the high death-rate of certain towns to the supply of soft waters. He will find, however, that when they were supplied with hard water the death-rate was higher; that many places supplied with soft water have an exceptionally low death-rate; and that, in those which have a high death-rate, there exist other very sufficient reasons for it. The idea, also, that drinking soft water impairs health on account of the absence of lime from it, is contradicted by the fact that some of the finest and healthiest of our population, such as the inhabitants of the Highlands, of the Lake district, and of the Millstone Grit districts, drink soft water, and a finer or a larger-boned race it is hard to find."

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* Vide evidence of Dr. Lyon Playfair in the Sixth Report of the Rivers Pollution Commission, page 189.

† "Manual of Hygiene."

Dr. Gairdner, of Glasgow, contributes similar testimony, for he states that he does not know of a single fact showing that soft water, when introduced in the place of hard, has in any instance led to an increased death-rate, or produced an appreciable bad effect, where the other sanitary circumstances have been good.

The Scotch babies are well known to be the finest in the world. They may obtain the lime, that is deficient in the waters of the lakes, from the oatmeal on which they are to such a great extent fed. Adults and middle-aged people, so far as my experience of nearly twenty years as a medical man extends, never suffer from the use of soft water, but very often from the employment of hard water. They obtain lime from a variety of sources, on account of their exceedingly mixed diet. I am bound, however, to acknowledge that my experience leads me to believe that a water of moderate hardness is more wholesome than either a very soft water or a very hard water; and that a very soft water, such as rain, not containing an excess of solid matters, like many artesian waters, is preferable to a very hard water for constant use.

I maintain, then, that in cases where a cottage cannot be supplied with water by wells, except at a cost wholly disproportionate to the value of the property, and no spring is available, its occupants should be furnished with rain-water. The inhabitants of many Eastern countries rely solely on rain as their water supply. Although it is not water of the best quality, it is the best obtainable, and is, of course, far preferable to the offensive ditch or pond water with which many a poor cottager is at present compelled to content himself. Water varies in quality like any article of commerce. . All cannot obtain water of the best quality. The waters of some wells are so full of salts as to be by no means of good quality ; yet these waters are the only supply in certain districts, the people living in them being under the necessity of drinking the best water that is procurable.

Rain-water is, moreover, not entirely destitute of hardness, as many people imagine, for it acquires a certain amount from the surfaces on which it falls. I have several times found rain-water, collected in situations far away from any smoke and its associate sulphurous acid, exhibit 1·3 degrees of hardness. Dr. Mitchell Wilson has stated that rain-water collected from the roofs of houses required five measures of soap test before a perfect lather was obtained. Rain-water does unquestionably dissolve saline matters existing on the surfaces on which it falls. It is mainly for this reason that I advocate the passage of rain-water over a few broken oyster-shells before it enters the storage tank.

A Rural Sanitary Authority possesses the power of compelling all owners of house property to furnish their tenants with a *proper* supply of water, the word proper being defined by the Local Government Board to mean a sufficiency of pure water. A landlord having been thus called upon by the Sanitary Authority, may express his desire to accede to their request, but with good reason may regret his inability to do so, on the ground that the cost of a well would be more than the value of the cottage. Landlords would prefer to eject their tenants, and shut up their cottages, rather than supply water at such a cost. It would be very impolitic to force them to act thus, for cottages are already very scarce in many parts of the country. I propose, then, to show how isolated cottages can be supplied with a very fair amount of pure water at a trifling cost where the sinking of a well is impracticable.

In many places where a scarcity of water exists, the water of a rivulet may be advantageously stored by creating in its course a covered reservoir, with a tank attached for filtration through sand and gravel during periods of flood, always taking precautions against the possibility of the pollution of such a stream. Some owners of cottage property, who take a pride in furnishing their tenants with the best of everything in a humble way, have provided galvanized iron tanks, but these tanks, when large, are of course expensive. An old ship's boiler, which is sometimes to be purchased for a small amount, makes an excellent rain-water reservoir. Another and more universally applicable mode of storing water for the cottager living on water-destitute formations, and lacking any water except that which is stagnant and filthy, or brackish and undrinkable, is to store that which falls on the roofs of the cottage and its outbuildings as rain and dew, in a tank made of Portland cement and gravel, or of bricks. It has been calculated that the family of the agricultural labourer has at present at its command about 1½ gallons a head daily, and in some parts of the country less than this small amount. An inch of rain falling on an acre of ground furnishes it with about 22,622 gallons of water, or about 141½ gallons per rod. Mr. B. Denton* has estimated that the average space covered by a farm labourer's cottage and outbuildings may be taken to be 2½ rods, and that if the water from rain and dew be properly collected by well-constructed eaves and troughs, and conducted by down-pipes into a tank sufficiently capacious to prevent overflow, no less than 7,070 gallons of water may be caught by such a receiving surface every year. This large figure is arrived at by multiplying the 2½ rods of surface by 141½ gallons, and then multiplying the result by 20 inches of rain and dew, an amount which can certainly be collected in almost any part of this country, even in the driest year. If this large annual total be divided by the number of days in the year, it will be found that the cottager has at his command about 19 gallons daily. The family of the agricultural labourer consists, on an average, of 5 members. When we remember that the husband is generally away from his home for the greater part of the day, and that one of the children is generally an infant, the family of the labourer must practically be considered, as regards water supply, as consisting, on an average, of 4 individuals. We have then more than 19 gallons daily for 4 individuals, or almost 5 gallons a head. To secure this amount the concrete tanks must be large enough to provide against long periods of drought, such as those from which we suffered in 1868. Some have considered that cottages do not possess so large a receiving surface as 2½ rods, and have calculated that 350 or 500 square feet would more correctly represent the average collecting surface of a cottage. I think, with an engineer whom I consulted as to the cost of rain-water tanks, that the medium estimate of 500 square feet would in all probability be the most accurate :—

Area of cottage, 26 ft. by 15 ft.	400 square ft.
Outbuildings of same, 12 ft. by 8 ft. 4 in.	100 ,, ,,
	500 ,, ,,

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* "The Storage of Water." E. & F. Spon.

The rainfall of the driest part of England, namely, the Eastern coast, is more than 20 inches annually. Allowing for evaporation and waste, that amount may be taken with perfect safety. The collecting surface, then, will receive about 5,200 gallons annually, or about 100 gallons per week, or about 14¼ gallons daily. The engineer above referred to has calculated that a tank to hold 2,400 gallons (somewhat less than a six months' store) would cost, if circular, 8 ft. in diameter and 8 ft. deep, about ten guineas in brickwork, and £10 in concrete. He thinks that a square tank to hold about the same amount, namely, 10 ft. by 5 ft. by 8 ft. deep, would cost £12. A small side filter containing sand, gravel, and charcoal, domed over in cement, and divided into two parts by a slab of porous freestone, is included in this estimate, which could be dispensed with. The price of a small iron pump is also allowed for. The estimate I received from a man who has had a large experience in cement and concrete work at Heybridge, near Maldon, agrees closely with the above, being—

For cement concrete tanks, including digging and boarding	6d. per cubic ft.
And for brick tanks, including digging and boarding, and rendering with cement	8d. ,, ,, ,,

In cases where a cluster of two or three cottages exists, it would be doubtless cheaper to construct one large tank than two or three small ones. Mr. Denton suggests the formation of tanks 16 ft. long by 10 ft. wide, which will hold 1,000 gallons in every foot of depth. He would cover over such a tank with a floating roof of half-inch boards fastened together, to prevent the entrance of dirt, and to reduce loss by evaporation. I cannot help thinking that such a large shallow tank would be highly inconvenient, and would consume more of the garden space than the cottager would like. At the same time it would be unwise to have a deep underground tank, which would involve the employment of a ladder whenever cleansing was requisite. I am inclined to think that a tank about 10 ft. by 5 ft. by 8 ft. deep, 2 or 3 feet of which are above ground, whilst the remaining 5 or 6 feet are beneath the surface, would be the best arrangement. In some places Portland cement and gravel are the cheapest materials for structural works; whilst in others, where gravel does not exist, stone or bricks are the most economical. If tanks be made of bricks and cement in clay soils, they should be protected from the entrance of water from the clay, which will render rain-water offensive, by thoroughly puddling their exteriors with tempered clay.

Rain-water tanks should be carefully protected from the entrance of dirt by a cover that can readily be removed. By placing a large flower pot or butter firkin with a hole at its base, containing sand and broken oyster-shells, underneath the pipe conveying the rain-water into the tank, the entrance of leaves or other extraneous matters is easily prevented. Rain-water filters for excluding all kinds of impurities from the storage tank are manufactured, such as Buck's Rain-Water Percolator and Long's Rain-Water Filter. If dirt is excluded by one of these contrivances, it will be but seldom necessary to clean it out. A small hand pump, which can be purchased for 25s., is required for raising the water from the tank.

By constructing a tank partly underground the water is kept cool in summer, and by having it partly above ground it is rendered more readily accessible to the cottager when he wishes to cleanse it.

If the rain is found by the cottager to have a somewhat sooty taste, this can easily be removed by passing the water through a common sand and gravel filter, which anyone can make out of a couple of large flower pots and a fourpenny wooden tap. One flower pot is painted on the outside, and a hole is made in its side, into which the tap is fixed, the aperture at the base being plugged up. The other flower pot is partly filled with sand and gravel, and is placed in the painted flower pot. The cottager may be assured that soot is perfectly harmless; that it consists mainly of charcoal, which is universally recognized as a disinfectant and purifier. On being called recently to a small hamlet situated on the London Clay, and entirely destitute of good water, where an outbreak of fever had occurred, traceable to the use of pond water polluted with the excrement of cattle, I visited the cottage of a shoemaker who preferred collecting the rain-water from his roof in an iron washing boiler, and passing it through a stone bowl (sandstone) about 1½ inches thick, to the employment for drinking purposes of the dirty mixture used by his neighbours. I mentally exclaimed, "Why should they not all do the same, seeing that water is here obtainable only at a depth of more than 300 feet?" That poor cottagers living under such deplorable circumstances will eventually, when people are more enlightened, be supplied with water in a manner similar to that in which the Israelites of old were furnished with food, I have not the slightest reason to doubt.

THE PRINCIPLES ON WHICH LEGISLATION RESPECTING THE POLLUTION OF RIVERS SHOULD BE BASED.*

So much has been written and spoken relative to the great question of the Pollution of Rivers that the minds of legislators and scientific men must be wearied with the whole subject. That the people of this country think it a very important one, and desire earnestly that some satisfactory settlement may soon be arrived at, cannot be doubted. To many it is a question fraught with danger to trade, and therefore to be opposed in every shape and form. And yet every one who has ever thought on the matter would, I believe, freely acknowledge that to convert our streams into open sewers is very unwise in every sense of the word. The public have apparently ranged themselves into two classes on this question, as they do on almost every public one ; those, consisting principally of manufacturers, who oppose legislation having for its object the prevention of the pollution of rivers, on the ground of its interference with trade; and another class, who advocate their restoration to the condition of trout streams. To permit the filthy inky watercourses of the manufacturing districts to remain in their present state is to allow a few score of men to afflict thousands with gigantic public nuisances. To quietly sanction the pollution of 3,000,000 gallons of river water daily by five firms, as at Bradford, and to complacently allow 75,000 tons of cinders to be annually deposited in the river Irwell, is, of course, suicidal policy. To argue that, because manufactories which pollute streams and air give sustenance to hundreds and thousands of workpeople on their banks, whose vital energies are lowered (thus rendering them a more ready prey to disease) and whose offspring are stunted and depraved by the unwholesome influences to which they are subjected,—to argue, I say, that, because these great industries fill the stomachs of these people, they ought not to be required to be conducted in a manner which is not detrimental to their health, shows a want of all proper feelings of humanity. Whilst, however, condemning an extreme degree of pollution, I do not, like many, think that it would be wise to be too exacting as to purity.

Those who are acquainted with the practical working of the Sanitary Acts, and are engaged in an incessant warfare with the development and spread of preventable diseases, know full well, that the principles on which all their work rests consist mainly in the prevention of air pollution and of water pollution. Filth in the air we breathe and filth in the water we drink is the one great enemy in two different media against which we Health Officers are always fighting. As the question of the pollution of rivers is primarily and essentially a sanitary one, and secondarily a commercial or pecuniary one, why, I ask, should not the same principles be applied in dealing with it as with all other sanitary evils which involve exactly similar considerations? It will, I presume, be acknowledged that for legislation on this question to be possible all extremes must be avoided. To advocate the restoration of our streams to a state of purity resembling that of a mountain rivulet is to obstruct and, in fact, to oppose all legislation on the matter. The crippling or destruction of many industries of national value would necessarily follow such an enactment, for the expenditure incurred in purifying their waste waters would consume or most seriously affect their legitimate profits. I maintain, moreover, that, if it were possible, it would be force wasted, for no adequate compensatory advantage would be gained. All who have paid attention to the very interesting subject of the effects on health of various kinds of water agree that spring water is to be preferred to all other kinds, and that river water *un*polluted to any extent by sewage needs more or less of purification by filtration, etc., which is costly, before it is fit to drink. The Duke of Somerset placed the matter in its true light when he recently said in Parliament :—"The foul matters encumbering streams may be got rid of, but the notion of their supplying water fit to drink must be altogether put aside. Towns must be supplied with pure water for drinking purposes in some other way." As the prevention of the pollution of the foulest of our streams would seem to necessitate the stoppage of important industries, and the purification of such streams so as to render them adapted for drinking purposes is of course not to be thought of, let us ask ourselves the questions—(1) What harm do these streams corrupted by sewage and trade products do? and (2) How are they to be prevented from inflicting injuries?

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* Read at the Social Science Congress of 1875.

(1) WHAT HARM DO THESE STREAMS CORRUPTED BY SEWAGE AND TRADE PRODUCTS DO?

(A) *Many of them pollute the air lying over them and on their banks.* Noxious odours sometimes or always arise and annoy those who live near them, or those living at a distance who approach them. If human beings are exposed frequently to unpleasant smells, a deleterious influence is exerted on their health. I know all that may be said in opposition to this statement. I shall be referred to the absence of any noticeable evil effects in London during the year when the Thames was so odoriferous, and to the supposed immunity from cholera and other preventable diseases of the sewer men of Paris, etc. It is a well-established rule, to which there are some apparent exceptions, that there is a greater mortality amongst those who are exposed continually to offensive odours than with others who are not so circumstanced, and that the diseases from which the former suffer are of an asthenic type and tend to death rather than to recovery. A certain amount of *vis medicatrix naturæ* is lost by them, and its want is felt at critical periods of sickness when most needed. Evaporation is constantly in a greater or less degree proceeding from the surface of water; and organic impurities contained in the water, if excessive, are mechanically conveyed into the air during this process of vaporization. The odours of many of these rivers, like those of foul ponds, are generally noticed more at sunrise and sunset than at other periods of the twenty-four hours, in consequence of the descending dew preventing their diffusion and rendering the impurities soluble and thus more perceptible to the sense of smell. My experience as a Physician has taught me that it is prejudicial to health to frequently breathe air polluted by emanations from very foul water. Unpleasant smells are danger signals, and although it is absurd to fear an attack of illness whenever we have our olfactory nerves offended, yet there can be no hesitation in saying that the continual exposure of the human frame to polluted air tends to engender ill-health, even if it does not create disease. The contamination of the air by many of these streams is as great a nuisance (taking this word in either its literal, legal, or popular sense) as the pollution of the air by volumes of smoke, which is, subject to some saving provisions, an actionable offence.

(B) *Many of them destroy fish.* Certain kinds of fish, such as the trout,* require, in order to live, water of great purity; others, such as chub, dace, roach, jack, barbel, perch, pike, eels, etc., flourish in water which would be considered comparatively dirty; whilst no fish whatever will, I believe, live in some of the most impure streams and in those poisoned by the metallic waste of mines. In rendering streams so foul or poisonous that no fish can exist in them, certain manufacturers and miners damage one of our food resources, by rendering an important article of diet scarce and dear, and therefore not to be procured by the poor man, and by lessening the self-reliant powers of the country.

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* The Gudgeon is said to be more liable than any other fish to be influenced deleteriously by impure water.

(c) *Silting up of watercourses and obstruction to navigation.* The quantities of solid impurities thrown into some streams are so great as to fill up their beds, thus creating inundations of their banks higher up. These solid matters produce a silting up of rivers, and an obstruction to navigation, by the accumulation of offensive banks of mud. On public grounds these evils should be rendered impossible.

(2) HOW ARE THE STREAMS TO BE PREVENTED FROM INFLICTING INJURIES?

The injuries being the pollution of the air (for no one ever thinks of drinking such water), the destruction of all kinds of fish, or an obstruction to navigation and to the escape of surplus waters during flood, my answer is simply and solely the following. Let our scientific chemists ascertain the point at which a stream begins to be so impure as to contaminate the air lying over it; and here let a line be drawn. Let them ascertain the point at which a water becomes so impure as to prevent life and multiplication of the less particular of the finny tribe; and here let another line be drawn. Let them ascertain the amount of suspended impurities a stream may contain, without depositing in its course sufficient to offer at some future time an obstruction to the ready escape of flood waters and to navigation; and here draw a third line. Whether these lines would coincide, or not, I do not know. Probably not. The nature as well as the quantity of the impurity would have to be considered in a question of this sort, the rapidity of the stream, and many other matters. Standards of some kind we must have, as well for the protection of the innocent as for the ready conviction of the guilty. To attempt legislation without any definite rules for guidance would be to court a failure. I maintain, then, that, instead of establishing such impracticable standards as were recommended by the Rivers Pollution Commission, we should adopt three simple standards of the kind just indicated. No stream should corrupt the air lying over it or on its banks, under any conditions of air pressure, temperature, or humidity, or level of its waters, for, if it does, it is detrimental to the health of those living near it. No amount of impurity in a river should be tolerated which would injure one of the food supplies of the people, to wit, the less dainty feeders amongst our river fish. No stream should contain suspended impurities in such quantities as would tend to its obstruction in time of flood and to the silting up of the mouths of navigable rivers. As for the practice in some parts of shunting large quantities of cinders, ashes, and solid refuse into streams in order to avoid the expense of carting them away, and of placing solid matters on the banks of rivers so that they may be washed into them in times of flood, such proceedings should be rigorously prohibited by law as being injurious to public interests.

It is illegal to pass any filth into a tidal river, according to the Public Health Act of 1875. If filth is passed into a river, and any one can show that he is injured thereby, the Health Authority of the district is liable to an action at law. Some rivers are guarded by conservators or water bailiffs, whilst others are not so cared for. How are the silting up of the banks of tidal rivers, and the accumulation of filth interfering with navigation, to be prevented in the case of rivers not fortunate enough to be possessed of guardians? It is of no use to forbid a thing whilst unpossessed of any power to prevent that which is forbidden from being effected. To establish three simple standards of the kind which I have suggested is to extend the sound principles of sanitary law, the burden of which is that you shall do nothing which is injurious to the health of your neighbour or to the public welfare.

Postscript.—Since writing the foregoing the Rivers Pollution Act of 1876 has, by the consent of all parties, been allowed to pass with a view to the settlement of the question. It insists on the adoption of "the best practicable and available means" for counteracting the evils with which it is supposed to war. The Act, however, has become a dead letter, and thus the matter is allowed to settle and rest.

IS ENTERIC FEVER EVER SPONTANEOUSLY GENERATED?*

THIS question, which is introduced to the Public Health Section of this great gathering of medical men, is one of the highest importance, not only to us here assembled, but also to the public at large. It cannot be wondered at that, amongst the profession, especially that branch of it engaged in the prevention of disease, this debatable query should eclipse perhaps every other one in interest, when it is remembered that enteric fever is as preventable a disease as small-pox, and that 140,000 cases of it occur annually in Great Britain, of which 15,000 prove fatal. To the public, whose attention has been particularly directed to this disease from its being (although declared to be a filth-disease) a scourge of royal families, attacking the prince as well as the peasant, it is an inquiry regarding which considerable surprise is often expressed that a satisfactory answer has not yet been arrived at. To that branch of the public which may be called the scientific public, the question opens up the very large one of Darwinian views and special creations. The profession has been divided into two distinct classes on this point. Amongst those who believe in the spontaneous origin of the disease we find the names of Trousseau, Murchison, Piedvache, Wood of the United States, Jacquot, Niemeyer, Guy, Bryden, Greenhow, Griesinger, Liebermeister, Hudson, and A. P. Stewart; whilst the distinguished President of this Association Sir R. Christison, Dr. Hughes Bennett, Professor von Gietl, Bretonneau, Gendron, and Dr. W. Budd, and last, but not least, the eminent outsider Professor Tyndall, are more or less sceptical as to its possibility. The limited space of time during which I have the ear of this Section compels me to confine myself strictly to the point raised by my question, and to avoid touching more than is absolutely essential on that part of the subject bearing the closest relationship, viz., as to the causes of enteric fever. This restriction is necessitated on account of the vastness of the literature of enteric fever, respecting which there has, I am sure, been enough written to fill a capacious library.

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* Read before the Section of Public Medicine, at the Annual Meeting of the British Medical Association in Edinburgh, August, 1875.

I do not propose, in the following remarks, to give a definitive answer to the question before us, which is one *sub judice;* but I would indicate the conclusion to which my experience of nearly twenty years as a medical man points, and desire to invite every one present to give by an affirmative or negative answer the opinion to which each has individually been led. It will be thus seen that my object in bringing this subject forward is rather to court the declaration of the views of the medical men collected here from all parts of the country, than with the hope of throwing any additional light on a very intricate point.

All physicians, and especially Health Officers, must be often struck by the difference which exists in the degree of contagiousness of the acute specific diseases. There is rarely any difficulty experienced in tracing outbreaks of small-pox, scarlet fever, or measles to their respective sources. They are all highly communicable diseases. I remember once, and once only, that I was perfectly unable to account for the occurrence of a case of scarlet fever in an isolated place. Upon reflecting on this case, which I often have done, I have always been disposed to ascribe the failure to a want of sharpness and diligence in searching on my part. Typhoid fever, diphtheria, and erysipelas are representatives of the opposite class of the acute specific diseases, namely, of those which possess a limited power of propagation. Although communicable from the sick to the healthy, cases of these diseases are continually cropping up in different parts far away from one another, where no connection can be traced to a prior case. As regards enteric fever, although this disease is undeniably possessed of contagious properties, numbers of single cases have occurred and been recorded where it has been quite impossible to discover any cause in the shape of a pre-existing case. Those who advocate the sole origin of enteric fever by contagion imply that the failure is due to the want of expertness and dexterity of the Health Officer. I most thoroughly echo the words of Sir William Jenner, who says:—"My own prejudices are greatly in favour of the specific origin of this in common with all contagious diseases. I have long advocated their specific differences, and that each has its specific cause, *i.e.*, a cause which is unable to produce any other acute specific disease. If each could in every case be referred to emanations from those previously sick of the same disease, it would tend greatly to strengthen the general views I have long held and advocated. I am prejudiced, therefore, in favour of this opinion. I hope it is true; but then I must say that at this moment the weight of evidence and argument is rather on the other side." (Etiology of Enteric Fever, "Lancet," February 20, 1875.)

A great number of cases have been carefully observed where no connection could be traced to pre-existing cases, with which all medical men are familiar, such as the "Westminster School Fever," the "Clapham School Outbreak," the "Peckham Police Station Outbreak," the "London Convent Cases," the "Donaldson's Hospital Outbreak," Dr. Maclagan's isolated case near Dundee, etc. Sir William Jenner has suggested that the best mode of settling this question is to thoroughly scrutinize every isolated case that occurs in out-of-the-way country places. In accordance with his advice, I beg to record a number of isolated cases of enteric fever which I have investigated. As the limits of this paper forbid the description of each of the cases, I must content myself by giving a summary of them, and a brief sketch of one or two of the most interesting.

Isolated Cases of Enteric Fever.

No.	Initials and Reference in Visitation Books.	Traceable or not to Pre-existing Case.	Insanitary Conditions observed, etc.
1.	C., No. 1, Writtle.	No.	Privy stenches; dirty pond-water drunk.
2.	R. S., Oct. 16, 1873, No. 13, Great Waltham Parish.	No.	Privy stenches. Drank occasionally of brook close to outlet of village sewer. There has been no case of fever in village.
3.	J. G., Feb., 1874, No. 36, Great Waltham Parish.	No.	Drinking-water from ditch by side of lane. Stenches.
4.	W. F., and M. M., No. 38, Danbury Parish.	No.	Pond-water, polluted by their own excrement, is employed for drinking.
5.	C., No. 52, Buttsbury Parish.	No.	Untrapped drains. Well-water polluted by excrement from the cesspool.
6.	M. G., June, 1874, No. 56, Great Waltham Village.	No.	Returned from Colchester Hospital five weeks before illness. Water pure. Frequented very foul semi-public closet. Not possible to trace it to Colchester.
7.	C. C., and his family, No. 78, Great Baddow Parish.	No, but possibly contracted in Gt. Baddow Village, where cases of fever occur every now and then.	Drink rain-water from roof. In consequence of drought, have recently been drinking the filthiest ditch-water.
8.	H. C. S., Ingatestone Parish.	Returned ill from Norwich, where fever is prevalent.	
	G. G. and others, Sept., 1874, No. 89, Great Waltham Parish.	Returned ill from Springfield, where sporadic cases of fever are frequently occurring.	
10.	M. A. C., No. 96, West Hanningfield Village.	Yes.	
11.	W. R. D. S., etc., 111, Stock and West Hanningfield Parishes.	Yes.	
12.	A., August 26, 1873, Asheldam Parish.	No.	Water polluted by liquid manure of farmyard, and, after heavy rains, by contents of farmyard privy.
13.	A. F., Dec., 1873, North Fambridge Village.	No.	Water pure. Horrible stinks from privy and ditch.
14.	W. N., May, 1874, Heybridge Parish.	No.	Horrible stinks from private privy pervaded house. Drank river-water. Damp and filthy subsoil. No knowledge of any case of fever in neighbourhood, or along banks of river.
15.	A. A., June, 1874, Burnham Town.	No fever for some months previously in Burnham.	Three weeks before illness, patient cleansed out a very foul ditch, into which the sewage of Burnham flows and stagnates.
16.	C. O., July, 1874, Woodham Walter Village.	No.	Water exceedingly pure. Very foul privy, without cesspool, four yards from back door. Small yard saturated with fluid filth.
17.	J. C., Nov., 1874, Purleigh Parish.	No.	Water polluted by excrement.
18.	A. B., Nov., 1874, Burnham Town	No.	Impure water. Stinking drains.

No.	Initials and Reference in Visitation Books.	Traceable or not to Pre-existing Case.	Insanitary Conditions observed, etc.
19.	J. W. L., Jan., 1874, Mountnessing Parish.	No.	Horrible privy stinks at back door.
20.	A. P., March, 1874, Mountnessing Village.	No connection could be ascertained to have taken place between this and the last case.	Stenches from privy and foul ditch at back door pervaded the house, and spread for some distance, annoying travellers along the turnpike road.
21.	S. G., April, 1874, Mountnessing Parish.	No.	Closet 1½ yard from house. Filthy pond-water is drunk.
22.	J. L., March, 1874, Wickford Village.	No.	Drinking-water so polluted by farmyard filth as to be highly offensive.
23.	Warley Barracks, March, 1875.	No.	Drain passing underneath room in barracks found blocked up by large quantities of decomposing matter, which had evidently been accumulating there for a length of time, in consequence of the absence of sufficient fall to insure the exit of its contents.
24.	C. M., Little Baddow.	Yes.	
25.	E. W., Langford.	No.	Privy and cesspool in house. Soakage of excremental matters into wall of bedroom occupied by first case, creating stenches.
26.	J. W., Ramsden Crays.	No.	Stenches from privy about three yards from back door. Ground at back of cottage saturated with filth. Water supply liable to pollution from surface-water of road.
27.	W. P., Hazeleigh.	No.	Drinking-water obtained from rivulet which is polluted by leakings from two farmyards after heavy rains. Privy of one of the farms situated directly over the rivulet above the point where it is collected. No case of fever has ever occurred in this small out-of-the-way farm, nor amongst the labourers.

It will be noticed that three of the foregoing cases arose in Great Waltham, which is a very large parish, containing 7,342 acres, and that three happened in Mountnessing, a parish of rather more than 4,000 acres; these parishes being a long distance apart from one another. The dates of the isolated cases in these parishes evidently lead to the view that there was some communication between them, although none was traced: *e.g.*, No. 2, October, 1873; No. 3, February, 1874; No. 6, June, 1874—in Great Waltham: and No. 19, January, 1874; No. 20, March, 1874; No. 21, April, 1874—in Mountnessing Parish. That the poison of typhoid fever may remain in a dormant state, ready to become active as soon as conditions favourable to its development occur, is very probable, for the poisons of other diseases are well known to remain in an inactive state for varying periods of time. The appearance of two isolated cases at

Burnham, separated by an interval of some months, may possibly be in this way satisfactorily accounted for.

Of the twenty-seven isolated cases of enteric fever, three were clearly traceable to pre-existing cases of this disease. Excluding, then, all those respecting which there was a trace of doubt, namely sixteen, we find ourselves in the presence of eight, decidedly untraceable cases, namely, Nos. 4, 5, 12, 13, 16, 17, 23, and 25, four of which apparently originated from excremental pollution of water, and the remainder from excremental pollution of air.

No. 12. *Asheldham Outbreak.*—In August, 1873, enteric fever appeared in one of a row of ten cottages situated in the parish of Asheldham, contained in the Maldon Union. Seventeen of the cottagers contracted the fever, of whom six died. The cottages are situated in an unfrequented part, about nine or ten miles from the nearest railway station. Every effort which was made to discover any case of fever in the district failed. The rural population seemed exceptionally healthy at that particular time. All of the cottages, with one exception, were overcrowded, the bedrooms being fœtid with organic matter. The first person attacked was a young girl, who was in a depressed state of mind in consequence of having recently given birth to an illegitimate child. She was known to be a great water-drinker, and she drank freely of water which, although pure to the senses of taste, smell, and sight, was found to be composed of a mixture of pure spring-water, farmyard liquid manure, and, after heavy rains, of excremental matters from the farmyard privy. An analysis of the water gave one part per million of albuminoid ammonia. From this girl it spread to other members of the family. The neighbours who assisted in nursing and otherwise helping these stricken cottagers, took the fever, and communicated it to their own families, and thus it was disseminated by contagion, as was, of course, to be expected amongst dirty people living under unwholesome conditions. No trouble was spared in the endeavour to discover a pre-existing case, but without success.

The men who worked at the farm were all healthy, and had been so for some months. No one suffering from, or convalescent from, fever could be found who had visited the farmyard privy. In fact, at that particular time the district seemed quite free from any case of fever. No suspicion attached to the milk or other food supplied to the family first affected. It is, of course, just possible that some tramp recovering from fever might have communicated to the contents of the privy the specific poison of the disease; but all this is supposition.

No fresh case occurred after the cottagers were supplied with good water. The fever, in fact, immediately disappeared, and has not returned. The well which has been sunk furnishes water of the finest quality, containing ·04 part per million of albuminoid ammonia.

No. 25. *Langford Outbreak.*—G. W., a labouring man, lives with his wife and six children in an isolated cottage, which forms the lodge at the entrance of the grounds of a gentleman who occasionally visits his property, called Langford Grove. The cottage is about a mile from the village of Langford, where there has not been a case of enteric fever, to my knowledge, during a period of two years; since, indeed, it has been under my supervision. The wife, who was first attacked with fever, was in the habit of visiting the town of Maldon, about two or three miles distant, for the purpose of marketing, etc., once a fortnight. On May 19 and on June 4 she went to Maldon, and on June 6 she was taken ill. The medical officer of health of the town states that no case of enteric fever has occurred in Maldon during the past twelve months, except one in a low suburb unconnected altogether with the drainage of the town that proved fatal on March 1, 1875.

The family lived in a very quiet, secluded manner, never going away from home, and never having any visitors or lodgers. The lodge contained only two bedrooms, the larger being about four yards square, the smaller about four yards long and two yards wide. In the larger of the two rooms the husband and wife and baby slept; the other five children were stowed away in the very small room. On entering the larger bedroom, I observed a most foul odour, and noticed that a portion of the wall close to the bed was discoloured and wet. On inquiry I found that a privy with cesspool existed *in* the house, and adjoined the bedroom, and that excremental matters had soaked into the thin partition-wall dividing this privy from the bedroom, and had stained the wall at the bedside and made it wet. The occupants sorely complained of the stench arising from this wall, which was saturated with excremental filth. The noxious odour was so great sometimes at night, that the husband was compelled to open the window. They had only lived in the cottage for about six months, and had only recently, since the hot weather had set in, been excessively annoyed by the stinks. The previous occupants of the house had been quite unable to use this bedroom, and accordingly closed it on account of the nuisance.

Two of the children caught the disease of the mother. The husband looked ill and depressed, as if he had been exposed to highly unwholesome influences. The water supply was pure. There was no suspicion of the introduction of poison by milk or other article of food. On inquiring of the medical man in attendance if these cases were undoubted examples of enteric fever, and how he accounted for the appearance of the disease in such an isolated spot, he writes :—"I have no doubt about the Langford cases being enteric fever. The soaking of the privy filth through the partition-wall into the bedroom accounts, to my mind, for the outbreak. I am quite of the opinion that enteric fever is very frequently developed spontaneously by filth, etc." Every effort to trace the first case to a pre-existing one utterly failed. No one except W. and his family had visited the privy. The family, soon after the recovery of the children, left the cottage. On visiting it about a week or two after their departure, I again entered the offensive bedroom. The smell in it was not that of sewage gas, nor was it an ordinary privy stench, but was of a damp, fœtid character quite indescribable.

The suggestion of Sir William Jenner, that every isolated case of fever in rural districts should be carefully investigated, has led others besides myself to interest themselves in this question. The following cases have been recently recorded by Mr. J. T. Rouse, of Lyttleton, New Zealand, and Dr. Domenichetti, Medical Officer of Health of the Louth Combined Sanitary District.

Mr. Rouse writes ("Lancet," July 10, 1875):—"Enteric fever appeared in a house situated on the spur of a hill, 250 feet above sea-level, in which no disease of any kind had occurred previously. Only one house was situated higher on the spur, the drainage from which led quite away from it, and the occupants of which had never suffered from fever in any form. As is usual with houses built in such a position, there was a considerable excavation into the hill at the back, round which was a catch-water drain on the surface, running along the back and by the side of the house, intended to carry off storm-water, but which had been for a long time used as a channel for getting rid of dish-washings and house-slops, and which at the time spoken of had become foul for the want of sufficient fall. On April 12, 1871, the weather being at the time very hot, Mr. K., the occupant of the house, with some of his children, set to work to clean out and deepen this drain. They suffered considerably from the stench, which permeated the house, and caused nausea to those within as well as to themselves. On the

21st, I was called in to visit one of the younger children, who had unmistakable symptoms of typhoid; and within three days the whole family, including Mrs. K., who had been confined on the 19th, were all (seven in number) down with the same disease, which in each case presented the true signs of typhoid fever. All recovered; and it is worthy of note that at the time there was not another case of typhoid, as far as I was aware, existing in the town, nor did it spread among those who were in attendance upon the family. I cannot but think that this was a case of generation of the disease *de novo* from the putrid sewage disturbed in the alteration of the drain around the house, as I cannot see the possibility of any typhoid excreta having been present."

Dr. Domenichetti writes ("Public Health," July 8, 1875):—"A man, aged fifty-seven, was seized with marked symptoms of typhoid fever, which terminated fatally in about a week; and upon investigation it appeared that the drinking-water was at fault, though not suspected at the time, as it was derived from a 'blow well,' which in these districts is a term applied to water derived from the calcareous rock, and forced above the level of the ground by the pressure derived from the elevated sources of it in the 'Wolds,' six miles distant. Upon analysis, I found 1·5 grains per gallon of organic matter in it by the potassium permanganate test, and upon examining the premises, I ascertained that there was a stable-grating within a few yards of the well, which was situated in a courtyard, and I requested the owner to have the drain opened. Upon this being done, the tin pipe through which the water was conducted from the underlying rock was found to be corroded through, and at its base there was an accumulation of refuse from pig slaughtering, etc., quite sufficient to account for the contamination of the water. I should observe that no other case of typhoid fever had occurred near the spot for some time past."

Some scientific men argue that the origin *de novo* of a fever poison is as impossible as the spontaneous generation of animals and plants, and that enteric fever has existed from the commencement of time. Confining ourselves to the remembrance that certain diseases die out, and are superseded by others, let us reflect on the subject as practical medical men, avoiding for the present all speculation.

We all know very well that, although enteric fever is communicable, it is rarely communicated to the medical attendant, to the nurse, or to the inhabitants of the house, provided that the house be capacious (so that the poison is diluted), cleanliness be observed, disinfectants be used, the evacuations be immediately buried, and other measures adopted—all having for their object the prevention of air-pollution by the poison, the dilution or destruction of the poison if the air be polluted therewith, and the prevention of the exposure of food to its influence. We know also that, when it occurs in dirty cottages—the majority of which are, for all practical purposes, overcrowded and redolent of organic matter, where ignorance prompts the occupants (who generally look upon the visitation in a fatalistic manner) to depreciate the value of all preventive measures—this fever often does spread.

The experience of the London Fever Hospital shows that an abundance of fresh air and cleanliness are most successful in preventing the spread of the disease, and that stools of typhoid patients, although extremely prone to decomposition or fermentation, are comparatively harmless in a fresh state.

Given the same circumstances amongst an unvaccinated community, and small-pox will probably spread in the clean and well-appointed house as well as in the dirty overcrowded cottage, although not to the same extent in the former. This result, of course, arises from the fact that small-pox is a more contagious disease. Sir William Jenner writes:—"It is evident that the more contagious a disease—*i.e.*, the less the quantity of the poison needed, the shorter the time of exposure necessary, and the less preparation required in the system of the individuals receiving the poison—the less frequently, *à priori*, should we expect that the disease could be traced back to its primary source. While amongst diseases of the opposite class (such as enteric fever), which are the least contagious, and require for their spread a longer exposure or more decided dose of the poison, or the administration of the poison in a particular way by a special channel, the more frequently should we expect (if every new case were due to exposure to the emanations from the sick of the same disease) to be able to trace them to their original source, and the more easily should the parent case be discoverable. But, in fact, it is not so; for those which are the most contagious are the most commonly traceable to their origin, and those which are the least contagious can the less frequently be proved to have origin in contagion."

If cases of enteric fever, occurring singly in isolated country places far distant from one another, always arose from some communication with a pre-existing case, there should never, it may very reasonably be inferred, be the slightest difficulty in tracing out the source. But, as a matter of fact, it is often quite impossible to establish any connection whatsoever between these solitary cases and any outside case. To believe that this fever never arises *de novo*, it is necessary also to believe in occasional invasions by infected tramps, who, not being seen by the dwellers in these out-of-the-way places, must be deemed to be ghostly visitors! What circumstances do we find common to all those isolated cases of enteric fever that are not traceable to pre-existing cases? Either horrible stenches arising from decomposing excremental matters, or drinking-water poisoned with decomposing filth; either air pollution or water pollution invariably obtrudes itself on the notice of the medical man who endeavours to ascertain the cause. In reply to the question, "Where did the patient catch the fever?" the response frequently is, "Nowhere; he (or she) bred it, sir." There would seem a very deep-rooted belief amongst the rural poor and amongst country doctors that this fever is often what is termed "bred"; in other words, "not caught," but "generated." Those who do not believe in the spontaneous origin of this fever inquire: "How is it that people drink water polluted by excrementitious filth and organic putrefactive matters for years, and are never affected with fever, although they may have suffered from diarrhœa and other ailments evidently dependent thereon, until the arrival of a person suffering from fever amongst them?" This argument is the strongest in the armoury of anti-independent-origin advocates; and, although it has been answered in a certain way, it has not been met, in my opinion, quite satisfactorily. It is urged that "excremental pollution is one of several factors (such as a certain temperature, amount of ozone, or other atmospheric conditions) necessary for the production of the enteric poison; and, in the absence of the other factors, it may be inert, and that a person newly arrived is the first to suffer, in virtue of a well-known law that a change of residence predisposes to an attack of the disease." (Murchison's "Treatise on Fevers.")

Cases have occurred in my practice where diarrhœa has attacked one or two members of a family, whilst a third suffered more seriously, exhibiting the distinctive symptoms of typhoid fever, both affections apparently producible by pollution of the air or of the water with excremental filth. A case of this kind, mentioned at the meeting of the Epidemiological Society in April, 1874, deserves to be recorded. Dr.

Carpenter, of Croydon, was in charge of a school containing nearly 200 children. Fifty-four of them were attacked with diarrhœa in the course of three days, when no diarrhœa or fever existed in the neighbourhood. Suspicion at once fell on the well, into which sewage proceeding from the boys' urinals and washing-places was found to be trickling. The source of supply having been changed, no fresh cases occurred, and all the children, with three exceptions, were well in two days. These three cases ran through a mild form of typhoid of twenty-one days' duration, and exhibited distinctly marked rose-coloured spots. Dr. Carpenter states positively that no one recovering from or falling ill of typhoid fever could possibly have used these urinals, etc., for more than three months (probably much longer) previous to the outbreak.

The very curious outbreak that occurred in the family of Dr. Robert King, Physician of the Middlesex Hospital, and the interesting account of it published in the "Medical Times and Gazette" of August 2, 1879, deserve careful consideration. The only sanitary defect in his house arose from the existence of a connection between the overflow of his cistern with the soil pipe of his water-closet, the water of that cistern being, in consequence of the mistake of a new nurse, used occasionally for drinking purposes. There had not been any typhoid fever in that house, to his certain knowledge, for twenty years, and there was no communication between his own and his neighbours' drains. He writes:—"Now, it so happens that, for three or four years past, one of the inmates of my house has been affected with chronic mucous diarrhœa, and I have fully satisfied myself that the fæcal evacuations of this individual contain albumen. I am inclined to think that it is not only possible, but even probable, firstly, that the poison of typhoid fever is a soluble, and perhaps volatile body, formed on the ammonia type by the decomposition of albuminous matter derived from inflamed intestine—that it may be, in fact, a sort of animal alkaloid; and secondly, that in the case to which I have specially directed your attention to-day, the poison was most likely generated *de novo* in my own house-drain during the putrefaction of the albuminous stools already mentioned. I think also that, owing in a great measure to the obstruction created by the compulsory interposition by the sanitary authority of a mischievous valve trap at the point of junction of this drain with the main sewer, the gaseous products of the decomposition were prevented from escaping into the sewer, and, ascending the soil pipe, were absorbed by the water, which, as I have already indicated, was undoubtedly the medium through which the poison was conveyed."

There can be no doubt but that the existence of a certain condition of receptivity is necessary in an individual, and that this state is manifested in some persons at particular periods of a life and times of a year, and is never developed at all in others. It would seem also as if, during sleep (probably at daybreak, when the vital powers and the normal resistance of the body to the attack are at their lowest) there is a greater susceptibility to be affected by the poison than during the waking hours. It is, of course, illogical to argue that, because a disease can be proved to be often communicated by the sick to the healthy, it can never arise in any other way. The poisons that give origin to the diseases known as dysentery, puerperal fever, erysipelas, and pyæmia are believed by the profession to be produced *de novo.* Many, such as Maclean and others, who have had some of the best opportunities of studying dysentery in different parts of the world, maintain that the dysenteric stool is as contagious as the typhoid stool, and that the dysenteric poison is produced by the putrefaction of animal substances under certain circumstances. Puerperal fever, which often arises from accidental conditions, becomes sometimes actively contagious.

I refrain, for obvious reasons, from touching, however briefly, on the researches of Chauveau, Burdon Sanderson, Beale, Bastian, and Klein on contagion in relation to elementary forms of life, which are also directed to the solution of the great mysteries of the origins of healthy and diseased life, for they cannot be dwelt on in a few words relative to the question before us. Nor can the views of Professor Hallier, of Jena, as to the identity of the micrococci of the fungus named *Penicillium crustaceum* with the poison of the disease be considered. All discussion of the interesting questions as to the relation of the rise and fall of the ground-water to enteric fever, as to the omnipresence of typhoid germs in the air ready to develope as soon as they meet with a congenial soil and suitable conditions for multiplication, as to the probability or otherwise of the dissemination of the disease by other articles of food besides milk, and as to whether high feeding or the consumption of the meat of fevered or otherwise diseased cattle or sheep, or meat in a putrefactive state, have any etiological connection, must be reluctantly avoided. I have limited the question, for want of time, to the narrowest point; namely, that in which it presents itself in rural districts to the Health Officer who is stationed far away from railways, those disseminators of disease which are so indispensable to our comfort.

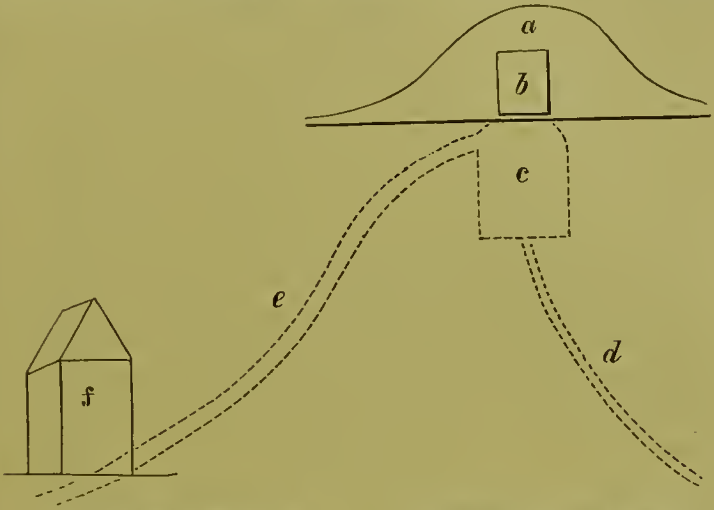
It has always been my opinion, which is continually receiving confirmation, that all air polluted by stinks, and water contaminated with an excess of organic matter, are deleterious to the health of those long exposed to their influence, although infinitesimally so, perhaps, in many cases where the powers of vital resistance are great, and that the filth-contamination of air or water may or may not be associated (we never know when) with a disease-ferment, *alias* filth-ferment, *alias* septic ferment. Enteric fever often occurs in isolated out-of-the-way places, where it is quite impossible to trace a pre-existing case, and where the only sanitary evil detectable is pollution of water or air by the products of fæcal decomposition or fermentation.

I do not express the opinion that the poison of typhoid fever is capable of spontaneous development, for we do not at present possess sufficient evidence to come to any decision on the matter. Although, if my mind be prejudiced at all in the matter, it is prejudiced in favour of the more philosophic view that enteric fever never arises spontaneously, yet my judgment points to the opposite conclusion. Just as the poison producing ague is generated in, and emitted by, earth laden with decomposing organic matters under certain states of climate and soil, so the poison of this fever may arise from some unknown changes in the excremental matters of flesh-eating animals under certain atmospheric conditions, and spread by contagion.

The consideration of this subject at this meeting of the British Medical Association appears particularly *à propos*, because the Edinburgh School is, I believe, considered to offer the principal opposition to the opinion that enteric fever is traceable to the pollution of air or water with the products of excremental decomposition, independent of the introduction of the specific poison from without.

Postscript.—An isolated outbreak not traceable to a pre-existing case has recently occurred in the rural parts of North Devon, the following notes of which have been kindly sent me by H. Foquett, Esq., M.R.C.S., the medical man in attendance. It is especially interesting from the fact that the water was not polluted by the entrance of solid or fluid excremental filth, but by gaseous emanations proceeding from a privy through the overflow pipe of the well.

He writes :—" A four-inch drain pipe opens into the top of the well, whilst the other end of the pipe has its opening in the soil of a garden closet fifty feet away and at a lower level than the well; the idea in this arrangement being to make the overflow of the well cleanse the closet. The water has been very low in the well for several weeks. I imagine that the said pipe has conveyed the foul gases of the closet into the well."



a. Grass mound covering well.
b. Door carefully nailed up.
c. Well.
d. Leaden pipe conveying drinking water to house.
e. Overflow drain pipe. *f.* Closet.

The drinking-water which was sent to me for examination was very clear and brilliant in appearance, but exceedingly filthy from the presence of organic impurity. As is usual in the case of waters poisoned by foul odours or sewage gas, it, notwithstanding this filth pollution, contained no excess of oxides of nitrogen, such as nitrates, etc., and only 1½ gr. of chlorine per gallon, whilst the microscope revealed the presence of bacteria and micrococci. I have elsewhere shown that water is almost as susceptible as milk to the injurious influence of foul odours—a fact which is not generally recognized.

THE DISSEMINATION OF ZYMOTIC DISEASE AMONGST THE PUBLIC BY TRADESPEOPLE.*

The subject of this paper will, doubtless, be regarded as one of an alarming character by the public at large, as highly objectionable by tradespeople, as very important by medical men in general, and as one of the highest interest and concern by medical officers of health.

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* Read before the Public Medicine Section at the Annual Meeting of the British Medical Association in Sheffield, 1876.

The necessity of preventing trades from being so conducted as to be injurious to public and private interests is admitted on all hands. We have not only Acts of Parliament which regulate the employment of dangerous substances used in trades, such, for example, as the Petroleum Act, the Pharmacy Act, the Acts relating to explosive compounds, as gunpowder and nitro-glycerine; but we have Acts which, although imperfect in their nature, regulate to some degree factories, coal-mines, bakehouses, workshops, etc. The employment of labour in such trades as lucifer-match making, fustian-cutting, the manufacture of mineral acids, of earthenware, glass, and metals, of percussion-caps, cartridges, paper, staining of prints, bleaching and dyeing, etc., is to a certain extent controlled. The first-named Acts, as also the Alkali Act, are designed to shield the public at large from the risk of an exposure to hurtful and poisonous substances, whilst the others are directed more especially to the prevention of injury to the health of those engaged in, and to the non-employment of those who are physically unfit to be exposed to, such unwholesome avocations. The protection of the public health by the regulation of offensive trades, such as those of blood, bone, tripe, and soap-boiling, and tallow-melting, is relegated to the Public Health Act of 1875, under which power is also given to compel the consumption of smoke in certain cases.

The existence of all these legal enactments shows conclusively that the principle of the regulation of trades has been deemed by the Legislature to be sound, wholesome, and expedient.

Legislation has proceeded on the assumption that, if a trade be so managed as to be injurious to the health of those engaged in it, or to the public generally, or in such a manner as to be a nuisance, *alias* an excessive annoyance or danger to the public, the best practicable means of preventing the evil shall be adopted. The several Rivers Pollution Bills have been drawn with this self-evident desideratum steadily in view. The Rivers Pollution Bill, that will sooner or later succeed in running the gauntlets of the Lords and Commons, will undoubtedly be thus framed; and the Air Pollution Bill, which, I fear, is in the very far distance, must be supported on this basis, if ever it is to be a reality. The liberty-loving people of this free country would never be able to submit to such interference with, and control over, their modes of carrying on business for less important considerations than those of national health and wealth.

Admitting, then, the facts—(1) that, in the interests of the public, it is highly desirable that trades should be supervised for public health purposes, and (2) that certain legal enactments at present exist of a very imperfect and limited character, having for their object the regulation of certain trades, so that they shall not be injurious to health—is it not a matter of logical necessity that, if it can be shown that there exist other trades not yet provided for, which are actively engaged every now and then in sowing broadcast the seeds of preventable disease, some remedy for such an anomalous state of things cannot be with any sense of consistency and justice longer withheld?

To prove to medical men, and especially to those amongst them who are engaged in the public health service of the country, that zymotic disease is disseminated by tradespeople amongst their unsuspecting customers, is really to waste time and to assume an ignorance of facts which they are constantly deploring. My object in addressing the Association on this subject is rather to suggest to, and consult with, those medical men who are attending this gathering, as to the best mode in which the existing sanitary law could be so altered and modified as to protect the public from the dangers to which they are exposed in this direction. As these lines will be read, however, by many who do not belong to the medical profession, it will be useful for me to narrate briefly a few instances of the spread of zymotic disease by tradespeople amongst those whom they serve which have come under my immediate notice.

CASE I. *Scarlet Fever in a Public-house.*—Scarlet fever was exported from London into a public-house in Essex. Whilst the children of the publican lay ill of this disease in the bedrooms, their mother, who was in constant attendance on them, descended to serve each customer who called to partake of refreshment. I, as medical officer of health, advised the temporary closure of this house of call, but my recommendations were unheeded. From that house, as was naturally to be expected, the fever spread into the surrounding parishes, and deaths resulted. There was no legal power to compel a cessation of business during the presence of this communicable disease in the house. It was found that the publican could not be punished under Clause 126 of the Public Health Act of 1875.

CASE II. *Outbreak of Typhoid Fever from Polluted Milk.*—An outbreak of enteric fever occurred in a portion of the town of Brentwood. Whilst the families affected were provided with different modes of disposal of excrement, some draining into private cesspools, and others discharging into the town sewer, and whilst the water employed by all, with one exception, proved on analysis, although derived from different sources, to be very pure, there was one condition in common: they all, except in one instance, were supplied with milk from the same dairy, and the dairyman washed out his cans with most offensive sewage-water. The exception to the rule was the case of a young man who did not deal with this dairyman, but who drank of the same water as that with which he manipulated his milk. I could not learn that anyone besides this young man employed this water for drinking purposes. I myself saw the milk-vendor milking his cows into a pail which resembled a filthy pig's bucket. His dairy, where the milk was stored in large pans, was situated virtually in a bedroom redolent of organic matter. My surprise was great to find that milk could be preserved for even a short time in a sweet state in such impure air. Why, I ask, should the lives of our children, who are the great milk-consumers, and our own lives be exposed to such dangers, when nothing would be easier than to have dairy establishments under proper sanitary control, in the same way as we at present have slaughterhouses?

Case III. *A Village School distributing Measles.*—Measles appeared in a parish under my supervision. On investigation, it was discovered that the day-school was the centre from which it spread; for the children of the schoolmaster, who lived at the school, fell sick of the disease one after another, and imparted it to the children who daily attended the school. I recommended that the schools, which were busily engaged in infecting the parish, should be temporarily closed.* The managers refused, on the plea that they should lose the Government grant, to secure which a certain number of attendances are necessary, although, when a school is closed by reason of the presence of epidemic disease, a reduction in the number requisite to secure the grant is allowed. There existed no legal power to compulsorily close the schools. Contrary to my advice, they were kept open, and they disseminated the disease in a most successful manner throughout the whole parish, which suffered severely.

The assemblage of "hands" at mills, factories, etc., where the half-time system is in vogue has been attended by the spread and multiplication of zymotic diseases in a manner which, notwithstanding all the Factory Acts that have been passed, is uncontrolled although easily preventable.

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* The mere exclusion of the children belonging to an infected family from school will sometimes prevent the spread of such diseases as measles and scarlet fever. When several families of a parish are infected, the closure of the public school will be generally found the most effective method of limiting their diffusion.

CASE IV. *Small-pox in a Public-house and Restaurant.*—A traveller who was temporarily lodging in a public-house exhibited an eruption, which proved to be that of small-pox of a confluent kind. On entering the door of this house of public resort, I could distinctly recognize the peculiar smell characteristic of the disease. In the bar, where men were drinking, the odour was still stronger. Trade was going on as usual. No remonstrance had any effect on the publican. There was no exposure of the sufferer, and it could not be proved that there was any exposure of infected articles. From this house the disease spread, and no legal means existed whereby the calamity could be prevented. The public were frightened some time ago by a report of the discovery of a bad case of small-pox lying in a shake-down bed in the kitchen of an eating-house in London. Some strong feelings were aroused as to the dangers to which people are exposed; but the circumstance was soon forgotten, and made no lasting impression on the public mind.

CASE V. *Enteric Fever spread by a Tailoring Establishment.*—A case of enteric fever appeared in the family of a tailor who lived in a small four-roomed house in a terrace. This tailor was employed by the fashionable and principal tailor of the town, who displayed his goods in a large and handsome shop situated in the best street. The assistant-tailor, whose four-roomed cottage was his place of business, where clothes were made and repaired, employed under him a journeyman tailor and a sempstress, who lived near. On my visiting the assistant-tailor's house, I found that work was proceeding as if no fever existed upstairs. Clothes were being manufactured there for the fashionable tailor with the handsome shop, who would soon distribute them to the unsuspecting public. The journeyman tailor and the sempstress both received from the assistant-tailor some clothes to be repaired. Both became infected with the fever, and communicated it to others.

CASE VI. *Scarlet Fever in a Village Grocery Business and Post-office.*—A child of a village grocer, who was the post-master of the district, became infected with scarlet fever, the poison of which was conveyed into the house from a distance. On ascertaining that the house was a small one, and that the mother and father passed from the bedside of the sick child into the shop to serve customers, and fearing, moreover, that the poison of the disease might be circulated through the agency of the post-office, I recommended the temporary closure of the business. My advice was disregarded, and no power existed of compelling compliance. The disease, of course, spread throughout the village.

Case VII. *Whooping-cough in a Village Beer-shop.*—Whooping-cough of a fatal character being very prevalent in one part of my extensive district, destroying in about four months forty children, attempts were made to prevent the spread of the disease from any cases imported into the other parts of the district. A case was conveyed into a beer-shop, and infected all the children of the publican. This beer-shop was daily frequented by many of the fathers and mothers of the village, or their children. I myself saw children entering, having been sent with jugs for beer by their parents. I recommended the publican to temporarily close his house of public call, pointing out the danger to the whole village which a refusal would involve. He quite acknowledged the risk to his customers, but assured me that he could not afford to temporarily close his business. This assurance would have been received by me *cum grano salis*, had I not good reason for knowing that he spoke the truth. I asked the legal adviser of the Sanitary Authority whether some compensation could be granted by the Authority, if the publican agreed to close his house, but found that the auditor would not sanction an outlay of this kind, as the law does not provide for such an expenditure of public money. The disease, as was only to be expected, spread amongst the customers, and occasioned three or four deaths.

The absence of any power to afford compensation has recently been authoritatively declared by the Local Government Board in the following case. Scarlet fever of a mild description was imported into the families of some "Peculiar People," living in a village, who kept the matter a secret. The children attended the National and Dame's Schools during the desquamative stage of the disease, and, through these schools, infected a portion of the village. I recommended that both of the schools should be temporarily closed. The clergyman of the parish, who had the control of the National Schools, consented. The periodical inspection and examination of the children had just been completed, and there was no danger of losing the grant. The old dame, who taught the very young children of the parish, and who had to maintain her still older husband (above eighty) out of her weekly earnings, also closed her school; but very naturally looked for some compensation, as she could not afford to be deprived of her weekly pittance. The legal adviser of the

Sanitary Authority wrote to the Local Government Board, asking whether the Sanitary Authority could compensate the poor dame for the loss she would sustain by the closure of her school. The Local Government Board replied in the negative. In a former case of this kind I was obliged to compensate the dame out of my own pocket, as it was impossible to allow the poor creature to suffer. If village dames refuse to close their schools when engaged in propagating disease, there exists no power to compel them to do so.

To detail more cases of this description is needless. Dozens, all telling the same tale, are to be found published in medical and sanitary journals. Perhaps the most recent in the recollection of sanitarians will be that of the distribution of the scarlet fever poison, through the medium of cream, at a West-end party; and that of the discovery of a case of small-pox in a milk-shop at Manchester.

A cottage, used as a laundry or as a butcher's shop, may lodge in its bedrooms cases of typhus fever; a private school may disseminate scarlet fever through a district by means of its day-scholars; a grocer's shop or a public-house may be served by those who have just come from the bedside of persons dying upstairs of small-pox; the cottage of the village postwoman may contain some communicable disease, the poison of which she may distribute with the letters;—and yet there exists no power to temporarily close such disease-spreading establishments!

I have written enough to show what dangers surround the public, and as to the state of helplessness in which medical officers of health find themselves when they wish to prevent a tradesman from disseminating the poison of some disease with his wares—be it the milkman with sewage in his milk, or the schoolmaster who distributes a dose of the poison of measles with a knowledge of the three R's amongst the village children, or the sempstress belonging to some drapery establishment, whose lodging may contain children labouring under malignant scarlet fever, facts which may be unknown, in the absence of an Act for the compulsory registration of communicable disease, to any sanitary official. That our children should be subjected to the risk of being poisoned with sewage in their milk, because some milk-vendor chooses to wash out his cans and manipulate his milk with sewage-water,—that our wives and that we ourselves should be exposed to the chance of infection from wearing clothes ordered at some respectable shop, and made in some garret full of fever or other contagious disease, the existence of which is kept a profound secret,—is simply intolerable. If the liberty of the subject, about which we in this country hear so much, is to be maintained at the expense of a quiet submission to an exposure to such perils, I, for one, would pray the Legislature for less liberty.

The question now arises, as to how this evil of the dissemination of zymotic disease by tradespeople can best be prevented. On this point, I doubt not, there will be some difference of opinion.

My own view is that it can be averted—

1. By placing the regulation of all trades under the control of the sanitary authorities and their officers (the power to compulsorily close a school or public-house, etc., when necessary, would be of course comprehended in an enactment of this kind).

2. By enabling a sanitary authority to grant compensation out of the rates, in cases of temporary closure of business for the protection of the public, when the sanitary authority has reasons for believing the truth of an allegation of inability to sustain pecuniary loss on account of poverty.

3. By extending the provisions of Clause 126 of the Public Health Act (1875), so as to make it a misdemeanour for persons to endanger the lives and health of their fellow-creatures by wilfully spreading communicable disease in any way—an amendment which has recently formed the subject of a petition of the health officers of the country to both Houses of Parliament.

The proposal to place trades under the control of the health authority of the district in which they may be situated must sooner or later be carried out. It is merely a question as to the time when the public will become as fully alive to the importance of the subject as medical men already are.

There can be nothing unfair in expending public money in giving compensation to a very poor and struggling tradesman, when a sanitary authority compulsorily closes for a short time his business in the interests of the public. Sanitary authorities already possess the power of giving compensation to the owner on account of bedding, clothing, and other articles exposed to infection which they wish to have destroyed.

Again, when schools are closed under the advice of the health authority, in consequence of the presence of infectious disease, a certain compensation is granted to them in not requiring the same number of attendances as is usually needful to secure the Government grant.

Postscript.—In proof of the statement that the organs of public medical opinion have been for years, and are still, fully alive to the dangers pointed out in the foregoing paper, I append extracts from the "Lancet" and "British Medical Journal" relative to this question.

"All of the instances given by Dr. Fox demonstrate the need of granting greater powers to sanitary bodies."—*Lancet*, Dec. 23, 1876.

"We have within the last few months given many illustrations of the perils which beset the public by reason of the careless system of giving out work indiscriminately which obtains in certain trades. What are known as the 'sweating' and 'home work' systems among tailors are pregnant with danger to the general health, and it would be interesting to know, even approximately, how many cases of small pox in the present epidemic depended on the reception in the house of clothes which had been made in infected rooms, or by persons barely convalescent from the disease. A medical man writes to us this week to state that a short time back he had under his care several severe cases of scarlet fever in the families of working tailors, principally Germans, in the purlieus of Soho, at whose homes the work was carried on as usual. In one case a young man sat on the 'board' making a vest and trousers while in the highly dangerous period of the disease known as desquamation or 'peeling.' There were also in the same room two persons with symptoms of the malady. This family, writes our correspondent, like many others in the neighbourhood whom I attended, did work for the leading tailors and clothiers in the vicinity of Regent Street. The natural remedy for such a state of things would be for tradespeople to provide workrooms in which all their orders for wearing apparel would be executed, and where the hands employed would be under immediate inspection. Failing this, it might be possible to effect an extension of the Workshops Act."—*Lancet*, Dec. 30, 1876.

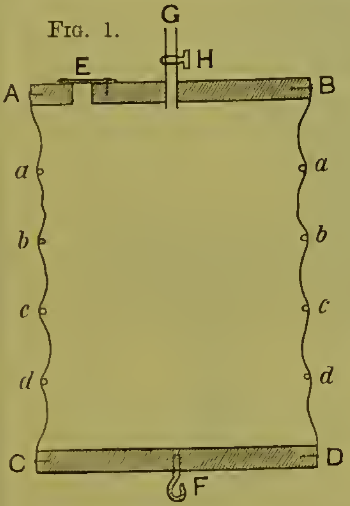
"PROPAGATION OF DISEASE BY NEW CLOTHES.—It is well known that the specific contagions of most of the zymotic diseases prevalent in this country readily become attached to textile fabrics; that, in such relationship, they long retain their activity; and that clothes, for these reasons, are especially apt to form the media by which infectious diseases are spread. It is a trade custom, which is especially in vogue in large towns, amongst tailors, dressmakers, and others who make clothes, to employ largely the services of outdoor assistants. Under this system, materials are 'given out' at shops to outworkers, who take the fabrics home, and there make them up into garments, which are finished, carried to the shop, and distributed to the customers. Such outworkers are usually poor persons, and they often live amid surroundings which practically make zymotic disease a perpetual circumstance of their existence. It can be no marvel that these poor assistants of tailors and dressmakers, with the payment of their toil often cut down to the lowest limit, and driven by the stress of poverty to work even when ill, sometimes infect or allow to be infected, through ignorance or recklessness, the materials on which they work. Scarlet fever and small-pox are the zymotic diseases which are especially apt to be spread under the conditions in question. This is so for the two following reasons: the subjects of scarlet fever and small-pox are very commonly able to do comparatively light work, such as needlework, especially in their own homes, and even upon their beds, during a considerable portion of the infectious stages of their illness; and the emanations from the subjects of scarlet fever and small-pox, which are conspicuously, if not solely, contagious, namely, the desquamated epidermis in the case of scarlet fever, and the desiccated crusts in the case of small-pox, are *materies morbi* which, relatively to the contagia of other zymotics, are very substantial, and especially liable to be caught and kept in the meshes of textile fabrics."—*British Medical Journal*, Sept. 1, 1883.

ON THE EMPLOYMENT OF ASPIRATORS IN ATMOSPHERIC OZONOMETRY.

A Paper read in the Section on Meteorology of the Conference held in the year 1876, *in the South Kensington Museum, in connection with the Special Loan Collection of Scientific Apparatus. President of Section*, John Evans, F.R.S.

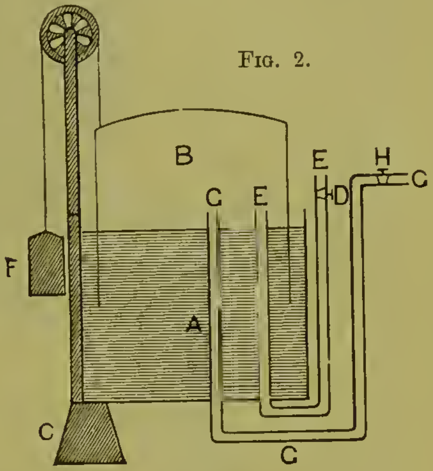
The words "Atmospheric Ozonometry," which strictly mean the measurement of the amount of Ozone in the air, have been employed to include the estimation of the quantity of the other air purifiers occasionally contained in the atmosphere, namely, peroxide of hydrogen and nitrous acid, which have been proved to influence test-papers in a manner which cannot be distinguished from the effects of ozone. The old-fashioned mode of detecting ozone was to suspend a test-paper in a box or cage, and there submit it to the action of the air. It was found that tests thus exposed rather acted as anemometers than ozonometers, on account of the continual changes in the force of the wind and the ever-varying quantities of air to which they were in this way exposed. Of course, the higher the wind the deeper the coloration, for the simple reason that more air passed over the test-paper. To obviate this important fallacy, aspirators have been employed for the purpose of passing a known quantity of air over a test. Large water-butts were constructed for this purpose, and I believe Mr. Smyth, of Banbridge, was the first to use aspirators of this cumbrous form. I think that Dr. Mitchell, of Edinburgh, in 1855, in Algiers, was one of the first to work an aspirator in ozonometry. It was a dry aspirator with a capacity of four and a half cubic feet, and was employed in experiments undertaken in Edinburgh in 1871.

FIG. 1.



A B, C D, Discs of Wood.
E, Valve.
F, Hook for attachment of a Weight.
G, Entrance Pipe.
H, Stopcock.
a a, *b b*, *c c*, *d d*, Wire Hoops.

FIG. 2.



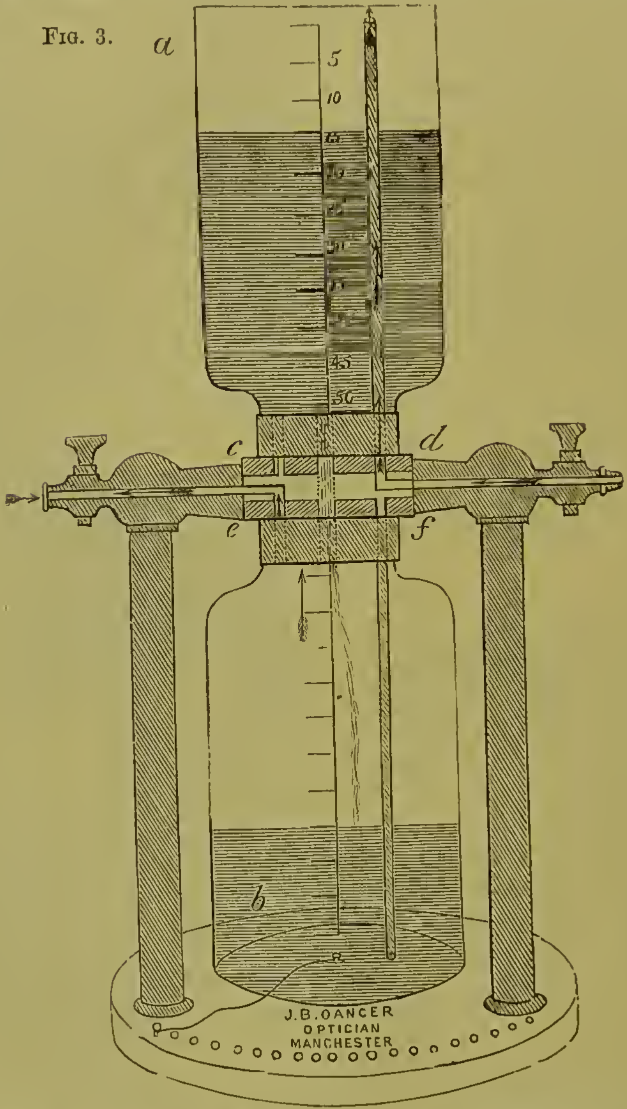
A, B, Copper Cylinders.
C, Foot.
D, H, Stopcocks.
E, G, Tubes.
F, One of the Weights which counterbalance the vessel, B.

This dry aspirator (Fig. 1) consists of a cylinder of mackintosh cloth closed at each extremity by a disc of wood. In the upper wooden disc is a stopcock through which the air enters, and a valve through which it makes its exit. When it is wished to make an observation, the lower disc is pressed upwards against the upper, so as to empty the aspirator of air through the valve. On the under surface of the lower disc is a hook, to which is sometimes attached a weight.

Equally cumbrous is the water aspirator devised by Professor Andrews, of Belfast.

This apparatus (Fig. 2) consists of two copper cylinders, the smaller being inverted within the larger which contains water. The inner one is supported by weights which are more than sufficiently heavy to counterbalance it. The base of the larger cylinder is perforated by two tubes that rise above the

Fig. 3.



a, *b*, Two glass jars, graduated into parts of a cubic foot; fixed mouth to mouth on an axis. *c*, *d*, *e*, *f*, Axis, the shaded part of which revolves with the jars.

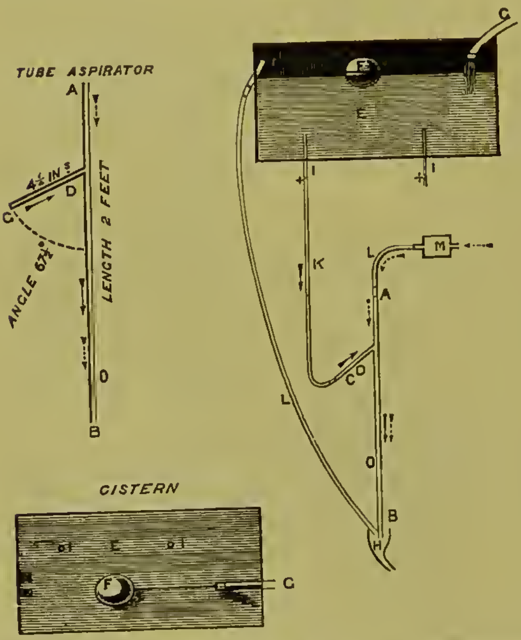
surface of the water, one being the entrance and the other the exit pipe. When one stopcock is opened, air enters and the cylinder rises. When the inner cylinder is full of air, the entrance pipe is closed, the exit pipe is opened, and the inner cylinder is pushed downwards, so as to empty it of air, either by the hand, or by a large annular weight allowed to descend on it.

A more portable instrument is Dancer's Reversing or Swivel Aspirator (Fig. 3), which is generally made in glass.

Some anonymous individual has had one of these instruments constructed of tin, which is exhibited in this Loan Collection. This reversing aspirator consists of two very large metal bottles or jars, fixed mouth to mouth on an axis, one of which is filled with water. When the upper vessel is full, the water flows into the lower, causing in its descent the entrance of air through one of the taps. The air of the lower vessel, as the water enters, passes out by the other stopcock. When the upper vessel is empty, it is simply reversed, until the lower one stands uppermost. A second charge of air may then be transmitted over the test. The number of charges is registered by placing an ivory peg in holes at the foot of the instrument. The necessity of occasionally reversing the jars is a great objection to this aspirator. It can only be removed by employing very large metal cylinders provided with glass graduated gauges. The ozone box is attached to the stopcock through which the air enters.

Now, these three varieties of aspirator are all constructed on the ever-changing velocity principle—on the same principle, indeed, as the common jar aspirators used formerly in chemical laboratories. The laboratory aspirator consists, it will be remembered, of a large jar of known capacity, with a hole at the summit, and another hole at the base. The jar is filled with water, which is allowed to run out at the base, whilst air streams in at the top to take its place. The opening at the summit is, of course, connected by a tube with anything over which it is desired to pass a known quantity of air. The aspirators to which I have directed your attention in this Exhibition are constructed, I say, on the same principle as the jar aspirator, namely, on the ever-changing velocity principle. When one commences to set either of these aspirators in action, the velocity of the entering air is much greater than when the operation is nearly at an end. From beginning to end the velocity of the air is continually changing. To remove this fault Dr. Andrews has had a clockwork arrangement attached to his water aspirator, in order to regulate the pace at which the instrument shall work. This addition increases the expense and bulk, already sufficiently great. It may be asked, What is the objection to aspirators which pass air over test-papers at a great velocity at first, and at a slowly diminishing velocity afterwards? I have shown by experiments, an account of which has been published,* that the velocity of the air passing over a test-paper has much to do with its coloration. When the velocity of the air is great there is less colour than when it is little, because chemical action takes time, and because, when the air is moist or hot, the free iodine or the iodide of starch is volatilized when air of great velocity is passed over a test. What actually occurs when an aspirator constructed on the ever-changing velocity principle is used, is that the air purifiers do not act on the test during the commencement of an experiment. As it proceeds the test-paper begins to be influenced, and towards its termination is decidedly acted upon. If perchance the test-paper during the commencement of an observation, when the velocity of the air is at its greatest, should be to a slight extent influenced, as, for

Fig. 4.



A B, Gas Tube, ¼ inch in diameter.
C D, Gas Tube, $\frac{3}{16}$ inch in diameter.
E, Small Cistern.
F, Ball Tap.
G, Supply Water Pipe.
H, Discharge ,, ,,
I, I, Gas Tubes, $\frac{3}{16}$ inch in diameter, inserted into bottom of cistern, and provided with small stopcocks.
K, India-rubber Tubes, ⅛ inch in diameter.
L, L, India-rubber Tube, ¼ inch in diameter.
M, Ozone Box.
N, Safety Pipe, to prevent inundation in case of formation of ice in cistern, and its interference with action of ball tap.
O, Exit portion of Tube Aspirator.
——> Indicates direction of current of water.
-----> Indicates direction of current of air.

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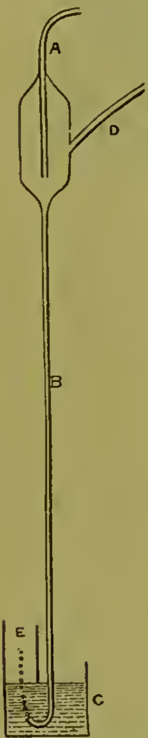
* "Ozone and Antozone—When, Where, Why, How is Ozone observed in the Atmosphere." P. 280.

example, when the air purifiers are *very* abundant, the free iodine or iodide of starch will most certainly be volatilized if the air be damp or hot, and will not be volatilized when the air is cold or dry. Here, then, is a fallacy which it is desirable to avoid, arising from variation in the velocity of the air, and from differences in the temperature and hygrometric condition of the air when that velocity is great. What we want is an aspirator which will pass a known quantity of air over a test at an unvarying and low velocity. I employed the simple tube aspirator (Fig. 4) for years in connection with a small cistern, the water in which was always kept at the same level by a constant supply from the main.

These tube aspirators of mine transmitted about 3,000 cubic inches of air per hour.

Fig. 5.

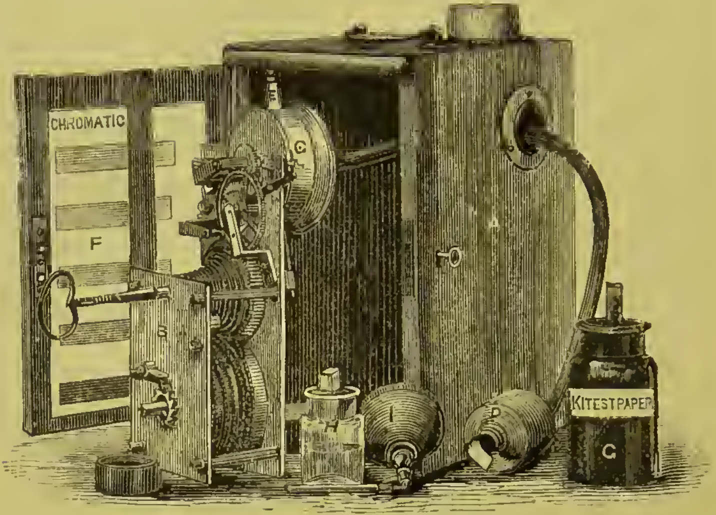


A, Water Supply Pipe.
B, Gas Pipe, ¼ inch in diameter, of any length up to 30 feet.
C, Vessel for Waste Water, and for the measurement of the air drawn through the tube.
D, Pipe to be united with the Ozone Box by means of an india-rubber tube.
E, Part of Vessel where the air is measured.

Mr. Dewar's water aspirator is in reality the same instrument, the water passing in at the end through which I allow the air to enter.

Christiansen's water aspirator is essentially the same in construction, consisting of a short glass tube, bent at right angles, inserted into a small hole in the side of an india-rubber pipe which is attached to the metal water supply pipe. The open end of the enclosed glass tube is, of course, directed towards the outlet. These tube aspirators all require water to work them. In towns this is to be obtained; but in the country, where many of us live, anything like a constant or intermittent water supply is out of the question. Many of my correspondents inform me that they have not sufficient water for domestic purposes, and therefore the expenditure of water for working aspirators is impossible. I am myself in a similar predicament, having to rely directly on the clouds for my supply. To meet my own wants and those of travellers abroad, and the requirements of those who have expressed a wish to carry on observations in ozonometry in our colonies and at other foreign stations, I have devised a portable clockwork aspirator which transmits a known quantity of air at an unvarying velocity, that velocity being low (*vide* Fig. 6).

Fig. 6.



A, Mahogany Box, with three small round openings, covered, when not in use, by brass caps, two being employed for passage of entrance and exit tubes, and the third, which is invisible in woodcut, for the passage of key of clockwork.
B, Clockwork, consisting of spring, chain, fusee, and
C, Fan Box, containing Fans, which revolve at great speed, and thus create a current of air, which enters through the Ozone Box, D, and escapes at the Exit Tube, E.
D, Ozone Box.
E, Exit Tube of Fan Box.
F, Chromatic Scale.
G, Black Bottle, containing Iodide of Potassium Test-papers.
H, Bottle, containing a solution of Tartaric Acid.
I, Spray Producer.

OUTLINE SKETCH OF LECTURE* "ON THE IMPURITIES IN THE AIR WE BREATHE AND IN THE WATER WE DRINK."

Delivered at Chelmsford, Essex, in 1876.

Some preliminary remarks having been made as to impure air and water, with a description of pure air and pure water, a detailed explanation was given of the different kinds of impurities communicated to the air by the lungs, the skin, by combustion, by sewage emanations, by noxious gases, by metallic and non-metallic dust, etc. The pollution of the air by Organic matter, both animal and vegetable, Carbonic acid, Carbonic Oxide, Sulphuretted Hydrogen, Carburetted Hydrogen, Sulphide of Ammonium, were all severally adverted to. In referring to Carbonic Acid, which is continually being expelled from the lungs, the amount of Carbon or Charcoal thrown off into the air by every adult in the 24 hours, and during every hour, was shown. It seems that no less than 150 grains are discharged by the lungs per hour, a quantity equivalent to 7½ ozs. in the 24 hours. The vitiation of the air of rooms by cast-iron stoves was especially referred to, which metal, being of a very porous nature, permits of the escape into the apartment of the most poisonous gas produced by our Coal fires, namely, Carbonic oxide.

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* Our legislators tell us that the existing sanitary law is already far in advance of public opinion, and that, in order to promote a steady progress in Public Health, a further education of the masses must precede any amendment of it. This enlightenment of the people can be accelerated

The practice of building houses without any contrivances for efficient ventilation was strongly censured. "Architects design houses, local boards pass the plans, builders erect places which are totally devoid of all provision for the admission of fresh air, and may be likened to Holes of Calcutta on the small scale. As for supplying change of air, by arranging for the passage through a room of warmed fresh air in winter and cooled fresh air in summer, of a healthful degree of humidity, such a proceeding is never dreamt of. The drowsiness which oppresses our congregations should more frequently be ascribed to the absence of any attempt at ventilation, than to the cause to which it is generally attributed. Omitting all reference to the dwellings of the poor, where no attempt at pure air is expected, who is there not acquainted with the abominable atmosphere to be met with in churches, meetings, concert-rooms, and theatres; whilst ball-rooms, drawing-rooms, dining-rooms, and bedrooms in the best houses are too often in a most disagreeable and unwholesome state of stuffiness."

The deterioration of air by manufactories, such as alkali works, copper smelting works, India-Rubber works, Cement works, bleaching works, by brickfields, glue refiners, bone burners, slaughter-houses, etc., was dwelt upon. The mortality

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by the delivery of Public Lectures throughout the country, illustrated by objects, so as to increase the interest of the audience. The following rough notes are not offered as a model, but as a humble suggestion or guide as to the sort of address that is required. They might form a skeleton or outline sketch to be filled up by any one desirous of spreading knowledge in this manner.

amongst miners, potters, knife grinders, button makers, pin pointers, cotton, wool, and silk spinners, stone masons, amongst workers with lead and mercury and arsenic, was deplored; and the suggestion was made that those possessed of talents of invention should turn their attention to the wants of these suffering thousands who are compelled to engage in such unhealthy occupations. The deleterious effects of frequent exposure to the emanations from ground having damp and filthy subsoil were pointed out. So great is the suction power exerted by the lights and fires in a house, that foul air is sometimes drawn into a building from filthy soil, or perhaps from a cesspool, situated at some considerable distance from it. An interesting experiment exemplified the porosity of earth and the influence of strong winds on ground air.

Impurities in Drinking-Water were next described, and were arranged under five heads: (1) Organic matter, animal and vegetable. (2) Poisonous gases, such as sewer gas. (3) Excess of lime and magnesia, in other words, excessive hardness; (4) Poisonous metals; and (5) Excess of saline matters. As to organic matter, all water in nature contains some organic matter. It is the excess that sanitary physicians object to, especially of that putrid kind derived from animals, in which the poisons of diseases flourish, because they find in filth a congenial soil for increase. The mode of contamination of water by sewer gas, as the result of an intermittent water supply in a town, was explained, and the following rules urged as beneficial ones for universal adoption:—"(1) Every town should have a constant water supply. (2) In Towns where the supply is intermittent no closet should be supplied *direct* from the main, but indirectly through the intervention of a cistern or a water waste preventer. (3) No one supplied on the intermittent system should drink water from a cistern. (4) No cistern should have an overflow pipe passing directly into a drain. (5) The overflow pipe should be cut off, and the overflow should drop through the air on to a trapped grating."

The evils resulting to the health from the employment of very hard waters, and the wholesome nature of rain-water as collected in the country, were alluded to. The folly, in a pecuniary sense, of towns supplying themselves with hard waters, and the desirability of all towns, that cannot obtain a water which is not hard, softening their water by Clark's process, if practicable (as it generally is) were dwelt upon. This process consists, paradoxical as it may seem, in adding quicklime to a hard water. The following calculation is contained in the Sixth Report of the Rivers Pollution Commission, as to the relative economy of the modes for softening water most popular with housewives, as compared with that of Dr. Clark. A cwt. of lime at a cost of 8d. will soften as much water as $4\frac{3}{4}$ cwt. of Carbonate of Soda at £2 17s. 9d., or as $20\frac{1}{4}$ cwt. of soap which costs £47 1s. 8d. The economy of softening water by lime is enormous, being 1 to 86 in the case of soda, and 1 to 1,400 in the case of soap.

Waters which contain an excess of saline matters, such as that of an artesian well, were described as not so wholesome as those possessing but a small quantity, as, *e.g.*, spring water.

The poisonous metals most frequently found in waters seem to be lead and copper, which are easily detected.

The third division of the Lecture comprised remarks on the principal diseases produced by impurities of air and water, such as typhoid fever, from which 140,000 people suffer and 15,000 die in this country every year; typhus fever, which appears confined to towns; and that dreadful scourge Consumption, which, although worse in towns than in the country, is indirectly, if not directly, preventable. The drying of the subsoil has been found to reduce consumption. There cannot be a doubt but that it is largely due to that one constant condition affecting the whole community, namely, the breathing of impure air. Asiatic Cholera in an epidemic form in the country was looked upon as a disease of the past, in view of the Sanitary efforts that are now being made. Diarrhœa and Dysentery are ascribed to impure air and impure water. Other diseases of a preventable character, such as infectious inflammation of the lungs, goître, etc., were also alluded to.

The fourth section of the Lecture was devoted to the consideration of the several modes of detecting and estimating the amount of the Impurities contained in Air and Water.

As to Air, the method of procedure seems to be direct and indirect. The former comprises a microscopical examination of the dust of air, either as caught by the help of a fluid such as glycerine on a microscope slide, or by the help of sterilized infusions of turnips, etc., as practised by Professor Tyndall and others; and a chemical examination of those bodies, such as Organic Matter and Carbonic Acid, which vitiate it.

The several processes for detecting the Organic matter contained in air, and the apparatus employed in such extremely delicate manipulations, were then described and exhibited. Simple and exceedingly ingenious contrivances were shown for calculating the amount of Carbonic acid present in the air of our rooms and houses. Although Carbonic acid is not so bad an impurity in the air of our houses as the organic matter, yet an estimation of the amount of this gas is a valuable index to the foulness of the air.

The "Household test," as it is called, consists solely in shaking ½ oz. of lime water with varying quantities of air in bottles of different sizes. Our rooms should always be kept so that a 10½ oz. bottle full of air, when shaken with ½ oz. of lime-water, gives no turbidity in that fluid. If there is any opacity produced, then the air is not sufficiently pure, and fresh air should be admitted.

The indirect method of air analysis or Ozonometry was then explained, which consists in an estimation of the amount of purifying agents in the air not consumed in neutralizing its impurities. A number of Ozone test-papers of different kinds which had been used in various parts of Europe were shown; and the most approved system of observing the air purifiers, namely, Ozone, Nitrous Acid and Peroxide of Hydrogen, now in vogue was explained. Ozone cages, aspirators, and other apparatus employed in making these observations were displayed.

The microscopical and chemical examinations of water formed the next subject of interest; the modes of ascertaining the amount of organic matter in water, its hardness, and the presence of poisonous metals, were all severally adverted to. The lecture was illustrated by chemical apparatus and a number of Diagrams, and was concluded by the assurance that purity of air and purity of water are two of the pillars (the third being good, wholesome, unadulterated food) which form the tripod on which rests

"The healthy mind in the healthy body.",

WHY SHOULD THE EXISTING SYSTEM OF REGISTERING SICKNESS BE LONGER PERPETUATED?*

THE necessity of a complete and accurate system of registering disease will be admitted by all those who are acquainted with the very alphabet of State Medicine to be urgent, if any decided success is to be achieved in the prevention of the spread of filth

* Read at the Social Science Congress, Aberdeen, October, 1877.

diseases, and if any advance is to be made in our knowledge of the natural history of other diseases. An eminent author has recently thus written respecting this want:—"The first sanitary work of the future, standing before all other sanitary legislation (except the formation of an efficient central Department of Health acting under the direction of a Minister of Public Health) is the systematic enumeration, week by week, of the diseases of the kingdom through its length and breadth. It is utterly hopeless to attempt any decisive measure for lessening the mortality, which is certainly more than double what it ought to be, until this State labour is faithfully carried out. To know the diseases of this country in their entirety, to know the relation of the diseases in men to the diseases of inferior animals and of plants, to be able to fix the special localities of the special diseases, to be able to trace the diseases back to occupations, modes of life, and all the external exciting causes from which they spring, were knowledge which every statesman surely should long to acquire. Such knowledge is the best history, the best book of reference that could be obtained, from which to read the health, and thereby the wealth, of our people."

The subject of the following remarks may be conveniently divided into three heads:—

1. A brief description of the existing system, if it can be dignified by such a term;
2. The proof that such a system is worthless; and
3. An attempt to find an answer to the query which forms the title of this paper.

I.—THE EXISTING SYSTEM OF REGISTERING SICKNESS.

The Medical Relief List of the Union Medical Officer, which is intended to contain the name in full and the age and residence of, the medical visits and extras in food, the quantities of brandy, port wine, etc., received by, every pauper, is the principal existing record of the great mass of sickness throughout the country generally, the registers that are kept in public medical institutions, such as lunatic asylums, etc., being alone excepted. This poor-law record is of a very short-lived nature. It was never designed to furnish material for statistical purposes, and generally soon finds its way into the waste-paper basket. Dr. Richardson has endeavoured to carry out on a small scale an experimental plan for the registration of disease. In 1855 he arranged with as many as fifty medical observers from forty-four different stations, extending from St. Mary's, Scilly, to Lerwick in the Shetland Isles, to send him information as to the epidemic diseases, diseases affecting the lower animals and plants, and certain meteorological observations, which were published quarterly in a Journal of Public Health. These returns were continued regularly for four years. Dr. Richardson writes of his attempt thus:—

"The success of the experiment for the registration of diseases was the actual cause of its failure. It was impossible for any one individual to bear the labour and expense of collecting and publishing regularly the returns of disease from fifty observers, though their valued labours were freely given. When, therefore, the experiment had been fairly tried and shown to be practicable, I laid the results before Sir Benjamin Hall, who was for a time President of the Board of Health, and suggested to him that the weekly records of the union medical officers of the kingdom should, by a very simple modification, be utilized for the registration of disease, after they had served the primary local purpose for which they were intended. Sir Benjamin Hall received the scheme with much favour, and promised to take the opinion of the Registrar-General upon it; but, after a little time, he informed me that the carrying out of the design would involve an expense which the public, he believed, would hesitate to meet, so the effort was not made."

Dr. Richardson proposes then to utilize the 3,200 returns of sickness (which have been calculated to contain not less than 3,500,000 cases of sickness per annum) that are weekly sent by the Medical Officers of the Poor Law Districts to their Boards of Guardians, and to work them into a system akin to that of the Registration of Deaths, which has been carried to so high a state of efficiency. If he knew as much of the "Beef Tea and Brandy Lists" (as the Medical Relief Lists have been contemptuously called) as do Medical Officers of Health, he would not urge the development of what I shall hereafter show to be a sham system of registering sickness (restricted to a certain section of the community, that is, those relieved at the expense of the rates) into what is required, namely, a national system limited to no class (for the very excellent reason that disease is not confined to a class), laid down on lines parallel to those systems for the Registration of Births and Deaths, of which, notwithstanding their imperfections, we as a nation are rightly proud.

II.—The Proof that the Existing System is Worthless.

If a system for the registration of sickness is to be of any value, information of the following kind is essential:—

(*a*) Sex of each sick person;
(*b*) Age ,, ,, ,, ;
(*c*) Residence.
(*d*) Nature of disease, in accordance (for the sake of uniformity and precision) with some recognized arrangement or classification, such, for example, as that of the Registrar-General, or the Nomenclature of Diseases prepared by the Royal College of Physicians for the use of the medical profession.

Let any one examine the accompanying collection of entries which have been copied out of records of sickness that are now expected to form the material out of which are manufactured the Quarterly Reports that the Local Government Board demands from Medical Officers of Health.

Sickness Returns.

Name of Pauper.	Age.	Residence.	Nature of Disease.	Remarks
Mary B...	7	Parish only	Sore throat	These four cases were all probably either scarlet fever or diphtheria. —C. B. F.
Rosamond B. ..	4	Do.	Scarlatina	
Philip B.	1	Do.	Diphtheria	
Freddy B.	10	Do.	Do.	
Robert P.'s wife ..	69	No entry	Uterine	
Joseph M.	61	Parish only	Inflammation	
Lucy W...	6	Do.	Congestion	
Playle's family. ..	No entry	Do.	Whooping cough	
Sarah P.	79	Village	Congestion	This case is likely to terminate in gangrene.
Thomas P.	65	No entry	Bedridden	
Mary S..	8	Scrofula	No entry	
John D..	64	No entry	Constipation	
Mrs. P..	54	Do.	Bilious	
A.'s child	13	No entry	Typhoid fever	
Ann P. and family	No entry	Parish only	Scarlet fever	
Jane A. and family	Do.	Do.	Do.	
Joseph R.	60	Do.	Short breath	
U. C.	No entry	Do.	Itching	
Mrs. H..	Do.	No entry	No entry	
John B..	Do.	Parish only	Bad eye	
W. G. and children	38	Do.	Inflammation of covering of membranes of heart and catarrh	
A.'s wife	60	Do.	Cough	
Saltmarsh	5 and 7	Do.	Bilious	
R.'s four children	No entry	No entry	No entry	
A. M.	43	Parish only	Injury	
W.'s child	6	Do.	Pulmonary	
R.'s three children	No entry	Residence given	Whooping cough	
M. S.	Do.	Parish only	Pregnancy, etc.	
John B..	Do.	Do.	Severe cold and brain irritation	
Smith C.	Do.	Do.	Hæmorrhage	
No entry	Do.	No entry	Decay	
Lilly (twins).. ..	4 months	Parish only	Dyspepsia	
T.'s child	2 months	Do.	Dyspepsia	
M. B.	No entry	No entry	Confined	
B.'s five children	Do.	Parish only	Bronchitis	

Sickness Returns, continued—

Name of Pauper.	Age.	Residence.	Nature of Disease.	Remarks.
B. S.	75	A. Place. No entry of parish	No entry	
Lowe (widow) ..	No entry	P. Cottage. No entry of parish	Do.	
A. B.			Eruption	
C. D.			Bad leg	
E. F.			Brain irritation	
G. H.	Do.	Parish only	Infirmity	
Y. Z.	78	Do.	Dirty	
R. N.	46	Parish only	Bilious fever	This case on investigation proved to be one of shingles.—C. B. F
		Do.	Disease of eyes	
O. P.	16	No entry	Heart affection	
A. (Miss)	No entry	Residence given	Eccentric in manner	
W. M.	64	No entry	Ulceration	
T. S.	No entry	Parish only	Compound fracture of humerus and fracture of scapula, abscess of axilla, congestion of lungs, and chicken pox	
S. E.	13 months	No entry	No entry	
B.'s child	2			

Nearly every entry contains one or more sins of omission or commission, and is not only worthless in itself, but invalidates the accuracy of the Sickness Return in which it appeared. These entries were not all picked out of the medical relief lists of some one lax Board of Guardians.

I have several times been frankly informed by Union Medical Officers that they do not often insert in their returns half the pauper cases which they attend. It may be asked: (1) Why do not Union Medical Officers fill up these Medical Relief Lists with greater accuracy? and (2) If they will not, cannot they be compelled to do so?

The answer to the first interrogation is, that Union Medical Officers are well aware that these Sickness Returns were never designed for statistical purposes, but simply for the information of the Guardians as to the number of cases attended and the extras ordered by the Medical Officer. Moreover, these diligent workers in the medical hive, whose lives are distinguished by much toil and little pay, are already insufficiently paid for the services rendered by them to the ratepayers. The answer to the second question, as to whether they cannot be compelled to exercise greater care and accuracy, is in the affirmative. Complaints have been made by Medical Officers of Health to Boards of Guardians, who have sent written expostulations to their Union Medical Officers, which have had for a time a beneficial effect, and then a relapse to the old slovenly ways has occurred. Then a complaint to the Local Government Board has been made on the subject, which has resulted in a communication from that Board to the Sanitary Authority acting for the Board of Guardians. Another remonstrance from the Sanitary Authority to the Union Medical Officers is the next step, followed by a temporary improvement; and then the whole performance *da capo.* The Medical Officer of Health, finding the Sanitary Authorities with which he is connected irritated by these frequent complaints, and powerless to compel strict obedience amongst gentlemen who are often disposed to resign *en masse* these appointments, on account of the paltry pittance (facetiously termed "remuneration") attached to them, ceases at length to indulge in a continual grumble, as no permanent good seems to spring from this privilege of an Englishman. Even if the Medical Relief Lists were as accurate as could be desired, they only give information as to the sickness of paupers.

III.—Why should this Worthless Mode of Registering Sickness be longer Perpetuated?

No good reason, so far as I know, exists for the continuance of this caricature of what is essential. The truth is, however, that the establishment of a complete system of registering sickness, analogous to that for recording births and deaths, would involve an interference with the liberty of the average Briton, for which that freedom-at-any-price-loving individual does not at present see the necessity, and which he would consequently resist.

As Local Self-Government with a minimum of Central interference is supposed to be the perfection of all human forms of government, and as some distinguished but unenlightened men, whose disciples amongst a certain description of ratepayers are very numerous, fear lest the priestcraft of past times shall give place to a doctor-ridden condition, which is equally mischievous, it is requisite, if fresh coercive and compulsory measures are to be obtained for the protection of the people, that the public themselves should demand them of the Legislature.

A Government cannot safely or wisely advance too far ahead of public opinion, but, in order to be of service, must lead, direct, and guide it.

Unfortunately, no scheme has yet been, or ever can be, devised for preventing one man from injuring his neighbour which does not involve some deterring or compelling influence. The instinct of self-preservation is too strong in human nature, and the strain of competition is in these days too severe to allow of the establishment of that Utopian condition of society in which those least endowed with worldly goods will be found to plunge themselves, and others relying on them for support, into difficulties for the sake of contributing to the public good. It is well known that at Manchester the local medical men have, in a public-spirited manner, made weekly returns for some years past of cases of sickness, and that a Committee of the British Medical Association has more than once reported on the Compulsory Registration of Disease. The legal powers that have up to the present time been acquired for obtaining a registration of sickness are purely local in operation. Several towns have obtained them. They are contained, for example, in section 67 of the Huddersfield Waterworks and Improvement Act, 1876, and in section 87 of the Bolton Improvement Act of 1877, and in clause 202 of the Greenock Police Act of 1877. In the first, every registered medical man in attendance upon a case of infectious disease is compelled to give a certificate notifying the fact to the person in charge of the case, and this individual is required to deliver the certificate to the Health Authority. In the second, the registration of infectious disease is made compulsory on the person in charge of the sick *and* on the medical attendant, and, in default, a penalty not exceeding £10. In the third, or last-named, the Board has acquired the power to demand from householders, when epidemic disease is prevalent, a report of all cases of such disease, and to fine any one who fails to comply with such order a sum not exceeding £1. All these efforts deal solely with infectious diseases; in fact, with a part only of a question of great magnitude. Is it not of almost as great importance to obtain a better knowledge of the home and distribution of such deadly diseases as consumption, cancer, etc.?

The consideration of the establishment of an efficient system of registering disease amongst all classes of the community is one of great moment, which involves an inquiry into a very large subject, including as offshoots details that would best be dealt with by a Royal Commission. The importance of the matter cannot be overrated. Of what use is it to make sanitary laws and to institute an elaborate system for the prevention of the spread of infectious disease, when the very foundation of the whole structure is faulty? Typhoid fever, for example, is fatal in about 10 or 12 per cent. of those attacked, and the great aim of an efficient sanitary organization should be to provide the Medical Officer of Health with prompt information of the occurrence of the first case, in order that he may take measures to prevent a second or a third case. Under present arrangements nine or ten or more cases of this fever may occur amongst non-pauper patients before notice of the outbreak reaches him through the Registrar of Deaths. The proposal to call upon a struggling tradesman to voluntarily inform the public that fever is raging in his house, and to require him to temporarily close his shop for the public good, without granting him some compensation out of the funds of the public (namely, the rates) whom he thus benefits, is thoroughly impracticable.

There can, I presume, be no question in the mind of any one who has taken an interest in sanitary subjects but that scarlet fever poison is disseminated by letters, for proofs of this accident have been repeatedly afforded. The outbreak of this disease in a village post-office has presented itself to my notice on two occasions, and in both cases the disease has spread. If a village post-office is temporarily closed on account of the presence within it of a virulent form of infectious or contagious disease, how are the transmission and delivery of letters to be in the interim provided for?

Such are one or two instances of the difficulties belonging to the project, which can, however, be easily overcome if the wish to surmount them exists. An exhaustive investigation of this very comprehensive subject of the Registration of Disease, amongst all classes, in all its bearings, by a Commission empowered to takesevidence, is urgently required; but, if this great desideratum is to be obtained, the demand for it must, as I said before, come from the public.

REMARKS ON A DISEASE KNOWN BY THE NAMES OF "FALSE DIPHTHERIA," "SPREADING QUINSY," AND "CYNANCHE PHARYNGEA."*

It is probable that few medical men in this country have been so circumstanced as to have had greater opportunities than myself for becoming intimately acquainted with *true* diphtheria. During the severe epidemic of 1859 an enormous number of cases came under my notice; and, even now, I am Medical Officer of Health in one of the Eastern Counties which, the Registrar-General informs us, are more afflicted with this disease than any other group of counties in England. It is unnecessary for me to detail all the symptoms of true diphtheria. The characteristic signs which distinguish it from throat-affections that resemble it are :—

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* Read in the Section of Public Medicine at the Annual Meeting of the British Medical Association in Bath, August, 1878.

1. The production of a tough leathery false membrane (διφθέρα, a prepared hide);
2. The presence of great depression of the vital powers;
3. The presence of albumen in the urine at an early stage;
4. The subsequent occurrence, in a certain percentage of cases, of some form of paralysis.

My surprise was great, in October and November, 1875, at encountering a disease, which was reported to me by the Union medical officer as quinsy, that spread amongst children. Knowing, of course, like every other medical man, that quinsy is not a communicable malady, although it may affect several members of a family at one time, who have all been similarly exposed to the same influences, or who may all have a family tendency to throat complaints, I made a thorough investigation into the matter, and described the affection in my Annual Report for 1875. The disease has since frequently presented itself to me in small local outbreaks. The principal facts brought out in my study of the disease have been these :—

1. The disease consists essentially in an inflammation of the tonsils, which extends more or less into the pharynx, and sometimes to the neighbouring submaxillary and other cervical glands.
2. Although yellowish spots are sometimes seen on the tonsils, from an accumulation of mucus in the follicles of these glands, no ash-grey tough leathery membrane (characteristic of true diphtheria) is ever seen during the course of the disease.
3. The individuals affected present an anæmic appearance.
4. The disease is communicated from one to another, generally through the medium of schools, gleaning, etc.
5. Unlike diphtheria, it is but seldom fatal,[*] unless those who suffer from it have been long exposed to most unwholesome conditions.
6. It is never followed by paralysis of sensation or motion, as diphtheria often is.
7. It is not accompanied by albuminuria.

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[*] Cases of true diphtheria have come under my notice which were of so malignant a character as to destroy life in twenty-four hours after the commencement of the illness.

8. The pulse is full, as is noticed in cases of acute quinsy, whereas in true diphtheria it is small and feeble, indicating great prostration.

9. It presents characters dissimilar from those exhibited by cases of scarlet fever without the rash, from which it does not confer an immunity. I have seen twenty children in one parish suffering from this disease, not one of whom displayed the slightest skin-eruption. If the scarlatinal poison had had any connection with the production of this affection, it is but reasonable to conclude that at least one or two cases would have shown some evidence of it on the skin.

10. It may prevail in a district where no true diphtheria is known.

11. The average duration of the disease is about ten days.

12. It is essentially a filth-disease, being always associated with some organic impurity of air or organic impurity of water. Overcrowding, saturation of soil around dwellings with slop-water, and employment of pond-water for drinking purposes, are the most common insanitary conditions found in connection with infected houses.

The outbreak before referred to, in October and November 1875, occurred in a parish situated on the London Clay, which, according to the statement of the Union medical officer, seemed to be annually invaded by this disease after harvest. What was there peculiar to this parish at that particular part of the year, whereby it differed from neighbouring parishes that did not suffer? The same, more or less offensive, privies and ditches exist in all; but, whilst the neighbouring parishes are furnished with artesian wells and springs, this particular parish is supplied with drinking-water by a stream, polluted at various parts of its course by soap-suds and drainage of farmyards. All the well-waters are brackish, and are only used for cleansing purposes. At harvest time, this stream is much reduced in size, and presents the appearance of a series of very dirty pools. The water is then so full of insects and dirt that the cottagers have to strain it. The men imbibe beer, and the women drink boiled water in the shape of tea, so that the children are the only drinkers of water in its natural (!) condition. Very little milk is ever consumed, as it is found to be too expensive.

Mr. Francis Vacher, whom we are fortunate enough to have as the Secretary of the Public Medicine Section, described ("Public Health," March 2, 1876) the outbreak of a similar disease (which Dr. Main regarded as identical with the cynanche pharyngea of Cullen) at Lower Bebington, in Cheshire. It occurred principally amongst adults, and only in two or three cases had a fatal termination. The only unsanitary condition peculiar to the district in which it occurred was an impure public supply of water, and it affected ladies who drank tea, rather than gentlemen who consumed beer and wine. It seemed to be confined to the area to which this impure water was restricted.

It may be urged that the affection respecting which I am making these remarks may be a mild form of diphtheria or erysipelas of the throat. Dr. Ringer considers that there are two kinds of diphtheria, a febrile and a non-febrile form. Dr. Balthazar Foster, whilst recognizing these two kinds, thinks that the non-febrile should not be regarded as diphtheria at all, and states that it is never succeeded by paralysis.

That mild cases of true diphtheria may occur is unquestionable. Dr. Blaxall related one to me, in which the patch of false leathery membrane was so small that it might easily have been overlooked. That it was true diphtheria was undoubted, for it was followed by paralysis of the palatine muscles. Dr. Russell Reynolds has referred to cases where the throat affection has altogether escaped observation.

Dr. Bernard O'Connor, in a paper in the "Lancet" (April 27 and May 4, 1878), has recently brought under the notice of the profession the disease that I have been describing, which he names "false diphtheria." He refers to nineteen cases, the average duration of which was about five days; and has formed the opinion that it mostly occurs in damp, close, and sultry weather. Air-impurity has doubtless some connection with this disease; whether etiological or not, it is impossible to say positively. I have met with it in a row of houses* over which sewage-polluted air was frequently streaming from a badly managed sewage-farm, the only highly offensive one that I have ever encountered. I have seen it in a very damp farmhouse almost surrounded by a filthy farmyard.

Dr. Thorne Thorne has noticed a general predisposition to *non-infectious* inflammatory sore-throat in a district, before the outbreak, in some part of it, of genuine diphtheria. He believes in the production, by means of a process of evolution, of that which gives to an already existing organism the property by which it becomes infective. I have no reason for suspecting that the *infectious* inflammatory sore-throat of which I write ever leads up to true diphtheria. As to the suggestion that this throat affection may possibly be of an erysipelatous character, I have never seen erysipelas in any other part of the body of an affected person. I remember that in one family, living in a most healthy locality, but drinking dirty water, the mother suffered from erysipelas of the scalp, and the father and several children exhibited this throat affection. I cannot regard this affection, then, as of an erysipelatous character, although, adopting Dr. Thorne Thorne's theory, it might possibly derive its origin from that blood disease and become infective. The tonsils are the primary seat of the local affection. The only points of difference between it and quinsy are, that it is communicable, that it is accompanied by a certain amount of anæmia and depression, and that the mortality from it is probably slightly greater. Mr. Arthur Clarke, a medical man of Stock, Essex, who was the first to direct my attention to the disease, calls it "spreading quinsy," and I think it could scarcely be better designated.

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* In this case there was a doubt (which I have also experienced when investigating the occurrence of intractable sore-throat in a house, the air of which was poisoned with drain smells) as to whether the disease was communicated from one individual to another, or was the effect of one common cause acting on all alike.

Sir John Rose Cormack suggests a very small blister on the arm or elsewhere as a sure test for distinguishing diphtheria from what he calls "simple membranous sore-throat." If the case be diphtheria, the blistered surface will become covered with a diphtheritic pellicle; if it be not diphtheria, no false membrane will appear. The public are too prone to speak of every throat affection by the name of diphtheria; and I regret to find that many practising medical men, more especially those in the rural districts, are less particular than they should be in the diagnosis and nomenclature of throat affections. As the disease does not often destroy life, the disinclination on the part of the public to submit to such an interference with individual liberty as will prevent its extension forms a difficulty in successfully dealing with it, which is almost insuperable in the present unenlightened state of opinion in the rural districts.

HOW TO KEEP THE EXTERNAL EAR IN A HEALTHY STATE. (1883.)

The external ear is generally considered by the public to be restricted to that portion of the auditory apparatus that is apparent to every one. When a physician speaks or writes respecting the external ear, he does not refer solely to the expanded portion or pinna, called also the auricle, which presents several eminences and depressions, and the shape, size, etc., of which is full of information to him, especially if he be engaged in psychological studies, but he alludes to the canal, the opening of which is so plainly visible, and is called technically the meatus auditorius externus, *alias* the auditory canal. It is not my intention to describe the diseases which affect the auricle or the auditory canal, nor the injuries to which they are especially liable, for a volume might be filled by an adequate narrative of their nature and treatment. I intend to confine myself to a few hints as to the best mode of maintaining these parts in a healthy state (which forms part of the duty of the toilet), and in this way of preventing them from becoming affected with disease requiring the aid of a medical man.

To insist on cleanliness of these parts, especially of the furrows and inequalities of the auricle, which are so exposed to dust and impurities of every sort, should not be necessary; but, that it unfortunately is so, is shown by the condition of these parts in the majority of mankind, especially amongst the young and aged.

Pinna or Auricle.—Cracks and fissures of the skin of the auricle are best healed by the application, night and morning, of the diluted nitrate of mercury ointment, which should always be employed in a fresh state, for a chemical change occurs in it if kept.

A sprayed and excoriated condition is best removed by the daily application of either a little oxide of zinc ointment, or by the dusting of the part with a mixture of the best arrowroot and (Hubbuck's) oxide of zinc (two-thirds of the former to one-third of the latter) through the finest washed muslin in the form of a little bag, or by means of a powder puff.

Rain-water and scentless curd soap are to be preferred for cleansing purposes, or Pears' scentless soap.

The Auditory Canal, or meatus auditorius externus, which is 1¼ inches long and terminates in the drum of the ear, possesses, near its entrance, hairs, sebaceous or fatty glands, and a number of ceruminous glands, secreting a brown-coloured wax designed to protect the drum of the ear from flies and dust. It is clearly, then, a mistake to be continually endeavouring to remove every vestige of wax from the ear—a pursuit in which some take an especial interest. Such persons complain of unpleasant sensations in the ears, noises, and temporary deafness after bathing—symptoms producible also by introducing cold water into the ears, either by dipping the head in a basin of water, or by means of a towel saturated with water. The *excess* of wax may be advantageously withdrawn, but the removal should be carried out in a suitable manner. The fashionable instrument amongst the *populus vulgaris* for extracting any collection of wax in the ear is the pin, which very often slips beyond the grasp of the fingers, and injures the delicate membrane lining the canal. Sometimes a very long one is used, or perhaps the head of a large stocking-needle, and then a frequent accident is the perforation of the drum of the ear, which produces deafness. Glycerine and oil are advocated by some as fluids with which the auditory canal is best lubricated for cleansing purposes. Glycerine attracts moisture from the air, and the mixture is an exceedingly cold fluid which I have known to produce evil effects, such as transient deafness, etc.; whilst olive oil is not felt by mankind generally to take the place of water in ablutions, the matters that require removal being themselves of a greasy nature.

The old-fashioned ear-tweezers, warmed by dipping into hot water, dried, and protected by rolling around its little cup-shaped extremity a piece of an old silk handkerchief, is the best contrivance for taking out of the entrance of the auditory canal any superfluous wax.

In performing the daily duties of the toilet, the auditory canal is best maintained in a healthy state by damping a small portion of a soft towel with cold water (warm, if cold ever produces earache or other discomfort), and, by the help of the forefinger, thoroughly cleansing therewith its orifice. Any excess of moisture should be immediately absorbed by introducing the ear-tweezers two or three times, covered as above explained, until, in fact, the enveloping silk no longer returns damp. An eczema, or exfoliation of the lining membrane of the canal in flakes and fine dust, is sometimes established by those who neglect to remove moisture from the canal after washing its orifice. If the moisture is not removed in some way or other, evaporation from the surface of the canal slowly proceeds, leaving a chilled condition, productive of a chronic inflammatory action. One of the causes of the production of dandriff of the scalp is to be found in the pernicious practice of allowing the hair to slowly dry after being wetted. A surgeon of my acquaintance suffered for many years from this annoying shedding of scales of epithelium from the auditory canal, which would sometimes fall out as a dust on the collar of his coat, and, when removed from his ear by any pointed instrument, left an inflamed and sore surface, which in a few hours was again covered with a fresh coating of epithelial flakes, creating an itching necessitating removal.

This morbid condition is easily cured by the application once or twice a day to the lining membrane of the canal of an ointment composed of oxide of zinc mixed up with vaseline. When benefit is experienced, the absorption of all moisture introduced by washing, by means of a soft, absorbent, pointed body, such as an ear-tweezers, on which a soft old silk handkerchief has been many times rolled, should be carefully secured. If so, the ear will get quite well, and the complaint will not return so long as the health of the lining membrane of the canal is thus attended to. An irritative and unhealthy condition of the lining membrane of the auditory canal will sometimes in certain individuals, who exhibit a reflex sympathy between the vocal organs and the ear, create a tickling cough, the cause of which is often ascribed to some affection of the lungs or throat, or even of the stomach. This irritation and its resulting cough, which I have christened "ear cough," may be induced by the presence of a foreign body in the auditory canal, such as a pea or bean, or piece of slate pencil, or accumulation of wax, or by the introduction of irritative ear-drops, or it may be due to a chronic inflammatory state, curable by a little oxide of zinc ointment. However produced, as soon as the irritation in the ear is removed, the cough, if dependent thereon, immediately ceases. At other times an offensive discharge, unaccompanied by any other unpleasant local symptoms, is noticed, especially in children who are teething or have decayed teeth, or are in need of cod-liver oil, iron, Parrish's food, or similar medicinal pick-me-up. The filling of the affected auditory canal with a few drops of warmed tannic acid glycerine, accompanied by the plugging of the tube with a little pledget of cotton wool, so as to retain it within its interior as long as possible, is the best remedy.

THE ELECTRO-PLATED DRINKING-FLASK.—AN UNRECOGNIZED SOURCE OF COPPER POISONING. (1883.)

A GRATEFUL patient once presented to me a very handsome electro-plated drinking-flask, which was of the newest and most approved pattern, being concave on one side, so as to adapt itself in the breast pocket to the convexity of the chest. On making an excursion into the country, it was my habit to fill my flask with a little sherry, or brandy and water, or claret, often Sauterne, in case of an emergency arising in which a stimulant or a drink to allay thirst might be required by myself or others. On a hot summer's day my flask and a few biscuits were my usual companions, when circumstances took me away from home for many hours. I soon began to be aware that the contents of my flask underwent a slight change in flavour, of a disagreeable character. As my senses are very acute, the change was not detectable by others. The taste becoming very unpleasant, I threw aside my beautiful electro-plated flask, and returned to a shabby old glass flask, protected by basket or wicker-work. Curiosity naturally prompted me to endeavour to ascertain if other electro-plated drinking-horns conferred on wines, etc., any disagreeable taste. I found, as the result of this inquiry, that all of these flasks acted more or less in a similar manner. The next point that presented itself was as to the cause of this change. Knowing that electro-plated goods are composed of copper covered with a very thin coating of silver, applied with varying degrees of skill, I suspected that whilst using the flask, I was slowly poisoning myself with the former metal.

Ultimately I discovered that sherry which has been kept in an electro-plated flask furnishes unequivocal evidence of the presence of copper, whilst a sample of the same sherry, submitted to the same chemical tests, yields no copper. To determine its presence or absence we should proceed thus :—

1. A little of the changed sherry is evaporated in a platinum dish to dryness, and to the ash is added a little dilute nitric acid. On leaving a strip of zinc in the acid for a few moments, it will be found that the platinum is coated with copper. After washing the dish, it is well to add a little liquor ammoniæ, which, whilst removing the copper, acquires a bluish tinge.

2. Whilst the evaporation is proceeding, 70 c.c. of the suspected sherry are poured into a small white evaporating dish, and a glass rod, which has been dipped in sulphide of ammonium, is introduced. If a black or brownish-black precipitate or colour is formed, which a drop or two of strong hydrochloric acid cannot remove, more than one-tenth of a grain of copper or lead is present.

3. To enable us to distinguish between these two metals, a little of the altered sherry is poured into a test tube, and a solution of ferrocyanide of potassium is added. A chocolate-brown gelatinous precipitate or claret-coloured fluid (if the amount of copper is small) is produced, which disappears on the addition of liquor potassæ—a reaction which is characteristic of copper. When brown sherry is operated upon, or any wine possessing much colour, it is desirable to decolourize it with

animal charcoal before employing the ferrocyanide of potassium. If it is considered desirable to ascertain the exact amount of copper present, it is necessary to make a standard solution of sulphate of copper (3·93 grammes in a litre of distilled water); but it is sufficient, as a rule, to determine the existence or non-existence of an appreciable amount of copper, remembering always that copper should never be introduced into the human body except as a medicinal agent.

Slow poisoning by small doses of copper frequently repeated gives rise to the most ambiguous symptoms, which often sorely puzzle the physician, and sap the health and strength of the patient. The symptoms are ambiguous, because they are common to many disordered and morbid states and conditions. Lassitude, unpleasant taste in mouth, loss of appetite, muscular debility, feelings of sickness, diarrhœal evacuations of a dark colour, headache, giddiness, a sallowness of the skin, are symptoms, many of which accompany a dozen different complaints. The simultaneous occurrence of all of these symptoms, especially if accompanied by a bronzed or purple line along the margin of the gums, should, and generally does, place the physician on the right scent.

Copper vessels are generally tinned with an alloy of tin and lead, but this protection is only a partial one, for it is apt to be worn away without attracting the notice of servants. Mr. W. Thompson discovered no less than 3½ grains of copper per gallon, as a soluble sulphate, in the water of a tinned copper boiler, the tinning of which was not worn away.* He was led to conjecture that some of the sulphuric acid in which the copper is immersed in the process of galvanizing had been retained in the crevices of the rivets and had dissolved the copper. A farmer once brought to me for analysis some ginger-beer that had been manufactured in a tinned copper vessel at his house. As it had apparently made several members of his family ill, he suspected that there was something wrong with it. On applying the foregoing tests the ginger-beer was found to contain a great deal of copper.

My *ménage* contains a very ancient copper stewing pan, on the handle of which are the words, "Y^E WAGES OF SIN IS DEATH," a quotation which is applicable in a manner never intended by the maker, who did not possess the knowledge that we enjoy as regards the retribution incurred by those who, in spite of repeated warnings, .persist in cooking their food in copper vessels.

* Vide "Chemical News," vol. xxxi., No. 801, 1875.

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